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FORESTRY ABSTRACTS

VOLUME I 1940 NUMBER 4

FOREST MANAGEMENT AND THE PHYSICAL PROPERTIES OF FOREST SOILS

THE importance of the physical properties of the soil for the development of plants has been established in forestry at a much later period than in agriculture. Ramann [11] was the first to conduct experiments on samples of forest soils with an intact structure, which he obtained by means of a cylindrical bore. He called attention to the porosity of the soil and considered it an indicator of its structural characteristics. Kopecký [9] introduced the terms 'water capacity' and 'air capacity' in their modern sense, water capacity meaning the amount of water which a soil of intact structure is capable of absorbing and retaining for a more or less prolonged period of time, and air capacity the volume of the pores in the soil which still remain filled with air after the soil has been saturated with moisture to its water capacity as already defined. In studying the physical properties of soils in their field condition, Kopecký elaborated the technique which, with minor modifications, was used by Engler in his well-known investigation on the influence of forest on the water level [7], and subsequently by Burger [2–6], Němec and Kvapil [10], Gulisashvili and Stratonovich [8], and other workers on the physics of forest soils.

Using soil cores of 1,000 c.c., Burger determined their water capacity and air capacity. The laboratory work involved [2] consisted in getting the soil sample into its standard moisture condition, determining the weight of the soil water, and finally finding the total volume of the soil particles when dry. The volume of the soil water plus soil air per unit volume of soil was then the difference between the apparent volume of the soil sample and the volume of the dry soil particles, so that assuming the density of the soil water to be that of ordinary water, its volume was easy to calculate, and the volume of the soil air or air capacity could be found by subtraction. Burger also determined permeability by means of filtration. He showed that the increasing fertility of the heavy Swiss forest soils depends on the increase of their air capacity and permeability and that both air capacity and permeability are considerably higher in forest soils than in comparable arable or grassland soils, although the total porosity (air and water capacity) of the forest soils need not necessarily be higher [2]. According to Burger's results, clear-cutting lowers the air capacity of the soil by some 40 per cent. and frequently reduces permeability to a small fraction of its previous figure. Thus the permeability of a good forest soil in Orvin was about 30 times greater than that of a comparable soil left bare for 10 years after clear-cutting. Even where artificial regeneration is established without delay, many decades pass before the soil regains its original structure [2]. He further proved that temporary agricultural utilization [2], stump-grubbing [2], or heavy thinnings where the soil is not protected by an under-storey [3], have a similar effect in reducing fertility, and that the afforestation of catchment areas with pure conifer stands, especially pure Spruce stands, does not increase the porosity and permeability of the soil sufficiently from a hydrological point of view [4, 5]. In recent experiments on soil improvement in Zofingen [6], Burger found that removal of moss and humus, and hoeing the top soil resulted in a decrease of permeability by one-half to three-quarters after an interval of 6 months.

In Czechoslovakia, Němec and Kvapil [10] examined the physical properties of sandy clays and sands under conifer, hardwood, and mixed conifer-hardwood stands. The data obtained confirmed Burger's view that high air capacity is an indicator of fertility in forest soils, and showed that the physical properties of the soil under mixed hardwood-conifer and pure hardwood stands are much more favourable than under pure conifer stands, especially with regard to aeration.

In the Central States, Auten [1] observed considerable differences in total porosity and in permeability between virgin forest soils and field soils. He found that where the forest cover is adequately maintained, second-growth forest soil does not lose its porosity unless grazing has been practised to excess or the litter has been destroyed by fire.

Basing their investigations on Burger's technique, Gulisashvili and Stratonovich [8] applied it on a larger scale to a series of soils differing in their formation according to the varied geographical

conditions of Russia. They studied during 1928–31 a total of 1,280 soil samples in the Pashe-Kapetsk and Shugozersk commercial forests of the Leningrad region, the Kuznetsk commercial forest of the Central Volga region, and the Shipov forest of the Central Chernozem zone. The main results of these investigations are outlined below.

1. The correlation between the productivity of a given forest type, and the separate structural characteristics of the soil occupied by that type, is specific for each climatic zone. In the moist Leningrad region, the most important single factor of direct influence on forest growth is soil aeration, which, in turn, depends on the total porosity and the non-capillary porosity (air capacity) of the soil. The greater the total and the non-capillary porosity of the Spruce and Pine forest soils of this region, the higher their productivity. In the relatively dry Central Volga region the increasing productivity of forests depends on the increase of capillary porosity (water capacity) of the soil. In the Chernozem zone the best soils, degraded chernozems occupied by highly productive mixed Oak stands, are characterized by considerable total, capillary, and non-capillary porosity, while more intensely degraded soils (dark grey, clayey forest soils) occupied by less productive Oak stands, have a much smaller total, capillary, and non-capillary porosity. In the case of alkali soils, chemical factors are so decisive in limiting fertility that the influence of structural characteristics is quite uncertain. Under approximately equal conditions of texture, the porosities, capillary and non-capillary, of forest soils, increase in European Russia from north to south, as the degree of podsolization decreases.

Table showing the changes in the physical characteristics of clayey forest soils, with decreasing podsolization (from left to right). The figures express percentages of the total volume of the sample.

Column I. Turfy podsol. *Piceetum polytrichosum.* (North-western territory.)
Column II. Slightly podsolized clay. *Pinetum tiliosum.* (Central Volga region.)
Column III. Grey forest clay. *Quercetum aegopodiosum-caricosum.* (Central Chernozem zone.)
Column IV. Degraded chernozem. *Quercetum aegopodiosum.* (Central Chernozem zone.)

	I	II	III	IV
Non-capillary porosity (air capacity)	2·8	8·9	9·7	11·9
Capillary porosity (water capacity)	38·0	43·2	50·0	55·8
Solid soil particles	59·2	47·9	40·3	32·3

2. Clear-cutting has far from a uniform effect on the structural properties of different forest soils. The effect depends on the climatic zone in which the soils are formed and it also varies within the same zone under different site conditions. In spite of this diversity, however, the soils investigated may be divided into two groups: according to their texture—clayey and sandy soils—and according to the degree of their podsolization. The structural properties of clayey soils are the more affected by clear-cutting, the less these soils are podsolized. Thus the air capacity of the least podsolized soils —grey forest clays of the Chernozem zone occupied by Oak stands—is lowered by about 40 per cent. In the slightly podsolized clayey soils of the *Piceetum oxalidosum* type the diminution of air capacity is less intense, though yet very considerable. The somewhat more podsolized clayey soils of the *Pinetum vacciniosum* type show only a moderate decrease of total porosity and of capillary porosity (water capacity), while turfy podsols occupied by the *Piceetum polytrichosum* do not change at all; clear-cutting does not make their physical properties any poorer, provided that intense swamp formation is not caused by climatic and topographical conditions. Finally, it may be said with regard to sandy, slightly podsolized soils of the *Pinetum pleurozio-cladinosum* type (Central Volga region), that the structural changes brought about by clear-cutting are negligible. The period of time required for the restoration of the original properties of the soil following clear-cutting is the greater, the farther north the region and the less humic the soil. Thus the effect of clear-cutting is less harmful in the grey forest clays of the Southern Oak regions, where the original structure of the soil is restored within 10–20 years, than in the more northern slightly podsolized clayey soils of the *Piceetum oxalidosum*, where the required period is 30–5 years, although the changes brought about by clear-cutting are smaller in the latter soils than in the former. Generally speaking, the deterioration of the physical properties of the soil may be lessened to a considerable extent if the under-storey is left intact or introduced before clear-cutting takes place.

3. The influence of temporary agricultural utilization on the structure of slightly podsolized sandy and clayey soils, is shown in the table on page 221.

The porosities are lowered significantly only in the case of clayey soils. In the Leningrad region,

the soils in question had originally a total porosity of 55 per cent., i.e. they were friable soils of site class I–II. The lowering of their porosity as a result of temporary agricultural utilization transformed them into compact to very compact soils approaching turfy podsols from a structural point of view. A similarly serious deterioration of slightly podsolized clayey soils is observed in the Central Volga region.

	Difference in per cent. of total volume of the sample, as compared to forest soil			
	Sandy soils		*Clayey soils*	
Slightly podsolized soils	*Leningrad region*	*Central Volga region*	*Leningrad region*	*Central Volga region*
Total porosity	+1 to +2	0 to −3	−7 to −10	−10 to −12
Capillary porosity	0	−3	−5	−10
Non-capillary porosity	+1	..	−1 to −2	−1 to −2

4. Data describing the main changes in the physical properties of the soil after forest fires are summarized below.

	Difference in per cent. of total volume of the sample as compared to unburned area			
	Clayey soils Leningrad region		*Sandy soils Central Volga region*	
Physical soil properties	*Podsolization slight*	*Podsolization intense*	*Podsolization slight*	*Podsolization intense*
Total porosity	−12	0	0 to −2	−2
Capillary porosity	−11	0	−1	−1
Non-capillary porosity	−1	−0·3	−0·5	−1
Soil water	More on burned area	More on burned area	More on unburned area	More on burned area

Significant compacting is observed only in slightly podsolized, clayey soils, while sandy and intensely podsolized, clayey soils either do not change at all or only to a slight extent. It may be assumed that the effect of slash-burning on clear-cut areas is similar to that of forest fires and that, therefore, slash-burning does not compact intensely podsolized soils and is probably useful in destroying raw humus, and in neutralizing to a certain extent the acid reaction of such soils.

5. With regard to the influence of the composition of forest stands on the physical properties of the soil, it was found that in the Central Volga region, sandy, slightly podsolized soils from Pine stands with an under-storey of Birch, Oak, Lime, Hazel, &c., possess a greater total and capillary porosity than similar soils from pure Pine woods, although non-capillary porosity is greater under the pure stands. As mentioned above, capillary porosity is a factor of great importance in the relatively dry Central Volga region.

The diversified geographical conditions prevailing on Russian territory thus enabled Gulisashvili and Stratonovich to come to the important conclusion, that in different climatic regions the connexion between the physical properties of forest soils and their productivity is variable, and that the changes these properties undergo under the influence of land management are likewise not uniform in different soils. The considerable progress made in recent work on the structure of agricultural soils [12], will no doubt stimulate further research on similar lines in the sphere of forestry.

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3. —— Physikalische Eigenschaften der Wald- und Freilandböden. II. Mitteilung. Einfluss der Durchforstungsart auf die physikalischen Eigenschaften der Waldböden. [Physical properties of forested and non-forested soils. II. The influence of the mode of thinning on the physical properties of forest soils.] *Mitt. schweiz. ZentAnst. forstl. Versuchsw.* 14, 1927 (201–47). German with French summary.

4. BURGER, H. Physikalische Eigenschaften der Wald- und Freilandböden. III. Mitteilung. Aufforstungen, Eigenschaften der Böden und Hochwasser. [Physical properties of forested and non-forested soils. III. Afforestation works, soil properties, and high water.] *Mitt. schweiz. ZentAnst. forstl. Versuchsw.* 15, 1929 (51–104). German with French summary.
5. —— Bodenuntersuchungen im Aufforstungsgebiet Teufimatt, Entlebuch. [Soil studies in the Teufimatt afforestation area at Entlebuch.] *Schweiz. Z. Forstw.* 81, 1930 (424–8). German.
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12. RUSSELL, E. W. Soil structure. *Imp. Bur. Soil Sci. Techn. Commun.* No. 37, Harpenden, 1938. pp. 40.

All the above contain detailed bibliographies.

ABSTRACT SECTION

NOTE.—A capital letter in square brackets following the reference denotes the language in which the paper is written. A small letter denotes a summary in another or the same language, e.g. [G.e.]—German, with English summary. English [E.] is only indicated for papers published in journals usually written in foreign languages.

0. GENERAL FORESTRY

01. TERMINOLOGY. METHODS

01:07. SAUNDERS, A. R. **Statistical methods with special reference to field experiments.** *Sci. Bull. Dep. Agric. For. S. Afr.* No. 200 [2nd ed.]. 1939. pp. 112.

01:12.14:24.21:44.3:45.3. CARTER, R. H. **Chemicals and methods used in treatments of trees by injections, with annotated bibliography.** E—467. Bureau of Entomology and Plant Quarantine, U.S. Department of Agriculture, Washington, D.C. 1939. pp. 25.

The objects of injecting trees have been (1) to trace the course of the sap stream, (2) to colour the wood for special purposes, (3) to preserve the wood from decay, (4) to cure diseases caused by deficiency of various substances, (5) to weed out undesirable trees by poisoning, (6) to stimulate and fertilize the trees by supplying nutrients, (7) to control fungal organisms and diseases, and (8) to control insect attack upon the trees. The author presents an extensive list, forming the bulk of the paper, of annotated references on the subject.

01:12.15 (213). BURTT DAVY, J., and KINLOCH, J. B. **The use of the term 'deciduous' as applied to tropical forests.** *Emp. For. J.* 18, 1939 (247–51).

A discussion of the diagnostic value of the terms 'evergreen' and 'deciduous' as applied to tropical forests. It is pointed out that leaf-shedding of certain species in the tropical rain forest is related either to flowering or fruiting (a sexual character) rather than to a resting period.

01:51. STAHELIN, R. **A slide-rule method as a substitute for straight axis alinement charts.** *J. For.* 37, 1939 (775–7).

For use in solving equations containing from four to six variables and where the relationship between the variables is known and is expressed by a linear equation.

02. DICTIONARIES

02. HENDERSON, I. F. and W. D. **A dictionary of scientific terms. Pronunciation, derivation, and definition of terms in biology, botany, zoology, anatomy, cytology, embryology, physiology.** 3rd ed., revised by J. H. Kenneth. Oliver and Boyd, London, 1939. pp. 383.

02. HUDON, J. E. Dictionnaire de locutions et termes forestiers techniques. Tôme I. Français-anglais. **[Dictionary of technical forestry terms and expressions.** Vol. I. French-English.] A–Butte, pp. 64 (Serial). *Suppl.* to *La Forêt Québecoise* 1 (1–8), 1939.

05.3. *Annual Reports*

05.3 (944). NEW SOUTH WALES. **Forestry Commission of New South Wales. Report for the period 1st July, 1936–30th June, 1937.** Acting Govt. Printer, Sydney, N.S.W. 1939. pp. 15.

07. TRAVEL AND STUDY

07:09.7 (42.1–8). SANZEN-BAKER, R. G. **Report on an excursion to Allerston Forest, 1939.** *Forestry* 13, 1939 (148–54).

Allerston Forest consists of over 11,000 acres, of which over 7,500 acres have been planted by the Forestry Commission. Two distinct types of land for afforestation are found: the exposed upland heaths and the sheltered moderately steep-sided valleys. The edaphic factors, the natural vegetation, the tree species chosen for afforestation, methods of planting and manurial treatment are described.

09.1. *Forest History*

09.1–2 (43.8). SZAFER, W. Zarys historji lasów w Polsce po epoce lodowej. **[Historical sketch of Polish forests since the Ice Age.]** *Roczn. Nauk rol.* 41, 1937 (246–8). [Pol. g.]

09.2 *Pre-history*

09.2 (77.3). VOSS, J. **Forests of the Yarmouth and Sangamon interglacial periods in Illinois.** *Ecology* 20, 1939 (517–27).

The pollen analysis of the Quincy and Nilwood peats, which represent only a portion of the Yarmouth period, reveals trees which can be regarded as climatic indicators and which suggest a cooler climate than the present. With the exception of the interval in late Sangamon times when some deciduous trees were present, the late Sangamon together with early Peorian interval were characterized by the dominance of northern conifer forms. *From author's summary.*

09.2 (79.7). HANSEN, H. P. **Paleoecology of a Central Washington bog.** *Ecology* 20, 1939 (563–8).

A pollen analysis of a montane bog of about 2 acres in the central part of Washington about 7 miles south-west of Wenatchee, Chelan County, at an elevation of 4,200 ft. It may have had its origin soon after the retreat of the last ice sheet and it is estimated that the peat deposit required 4,000 years to accumulate. The critical and best indicator species seems to be *Pinus ponderosa*, which probably records a gradual cooling and drying of the climate. Among other species noted were *Pinus contorta*, *P. monticola*, *Pseudotsuga mucronata*, *Larix occidentalis*, *Abies grandis*, *A. lasiocarpa*, and *Tsuga heterophylla*, together with species of *Acer*, *Alnus*, *Salix*, and *Betula*.

09.4. *Forest Statistics*

09.4 : 65 : 52 (47.2). TIKHOMIROV, B. I. **The quality structure [in terms of assortments] of Pine in the Angara Basin.** *Lesnoe Khozyaystvo, Moscow* 1939 (10), (47–9). [R.]

The region has 51·2 million hectares of forest with a standing volume of approximately 4·35 milliard cu. m., 11·6 million hectares with 1·47 milliard cu. m. being Pine. Among the Pine woods the 160–240 age group is most frequent. Recent preliminary sample-plot investigations showed that the percentage of first and second class timber was respectively 13 and 14 per cent. in the 100–160 years age group; 7 and 11 per cent. in the 161–240 years age group; and only 4 and 6 per cent. in stands older than 240 years.

09.4 : 09.7 : 98 (47.2–6). MIKHAYLOV, N. **Soviet Geography. The new industrial and economic distributions of the U.S.S.R.** Translated from the Russian by Natalie Rothstein. 2nd Ed. Methuen & Co., Ltd., London. 1937. pp. 229.

The table on the page opposite is taken from this book.

09.4 : 3 : 05.3 (71). CANADA. **The lumber industry 1936–1937.** Govt. Printer, Ottawa. 1939. pp. 81.

09.4 (75). *For. Surv. Release Appalachian For. Exp. Sta.* Nos. 1 and 2. 1939.

The forest resources of the Northern Coastal Plain and the Piedmont Region of South Carolina.

09.4 : 98.1 (75.7). FAULKS, E. B., and SPILLERS, A. R. **Forest resources of the southern coastal plain of South Carolina.** *For. Surv. Release Appalachian For. Exp. Sta.* No. 3. 1939. pp. 34.

09.4 (76). *For. Surv. Release Southern For. Exp. Sta.* Nos. 26–8 and 30–46 inclusive. 1937–9.

Giving volumes and other information on the forest resources in the Pine-Hardwood Region west of the Mississippi River, in Arkansas, North Georgia, North-West Louisiana, the North Arkansas Delta, North-West Florida, Central and South-West Mississippi, South-West Alabama, the Ouachita Mountain Region of Arkansas, Southern Oklahoma, Central and South Florida, the Longleaf Pine Region of Mississippi and East Louisiana, North-West Texas, the South Louisiana Delta, Central Georgia, South-West Louisiana, North Central Georgia, North Georgia and the South Arkansas Delta.

09.4 (77.4–6). CUNNINGHAM, R. N., MOSER, H. C., and WHITE, H. G. **Timber supplies, growth, and depletion in the three Lake States.** *Econ. Note Lake States For. Exp. Sta.* No. 11. 1939. pp. 12.

09.4 : 33 (78.6 : 79.6). WHITNEY, C. N. **Production of lumber, lath, and shingles in Idaho and Montana, 1938.** *Appl. For. Note Northern Rocky Mt. For. & Range Exp. Sta.* No. 91. 1939. pp. 3.

STATE FOREST RESERVES AND THE TIMBER INDUSTRY

Regions	Total area of forests on Jan. 1st 1934, in millions of hectares (excluding minor Forest Land)	Percentage of Forest Lands to general Area of Districts	Percentage of Timber Products in proportion to total timber resources	
			1928–9	1927 (plan)
Northern Region and Komi A.S.S.R.	66·3	41·2	14·3	15·3
Karelian A.S.S.R.	11·3	47·5	6·7	5·4
Leningrad Province	*18·8	22·5	10·6	7·3
Western Province	*3·3	13·7	7·5	4·4
Moscow Province	*2·9	13·0	5·5	2·1
Ivanov and Yaroslavl Provinces	3·6	23·4	5·9	3·5
Gorky and Kirov Provinces, Chuvash, Marii and Udmurt A.S.S.R.	11·1	33·4	11·1	11·4
Urals, Sverdlovsk and Chelyabinsk Provinces	†70·5	15·6	10·0	14·8
Bashkirian A.S.S.R.	4·2	23·4	1·9	1·5
Tartar A.S.S.R.	0·9	12·2	0·4	0·5
Kuibyshev and Orenburg Provinces, Mordovian A.S.S.R.	2·7	8·5	5·2	3·5
Kursk and Voronezh Provinces	0·8	3·3	1·7	0·9
Saratov and Stalingrad Provinces, Volga-German and Kalmuck A.S.S.R.	0·5	0·8	0·3	0·1
Northern Caucasus	1·9	4·3	0·8	1·1
Dagestan A.S.S.R.	0·1	1·7	..	..
Crimean A.S.S.R.	0·2	6·2	..	..
Kazakh S.S.R.	23·8	5·4	0·1	0·7
West Siberian Region	††60·1	22·6	..	6·2
East Siberian Province and Buryat-Mongolian A.S.S.R.	‡250·8	27·9	7·6	6·5
Yakut A.S.S.R.	277·2	37·9	..	0·5
Far Eastern Region	112·3	18·4	3·1	7·1
Ukrainian S.S.R.	2·5	4·0	2·9	2·9
White Russian S.S.R.	3·1	16·8	4·4	3·1
Transcaucasian S.S.R.	3·6	15·1	..	1·1
Uzbek S.S.R. (excluding Kara-Kalpakian A.S.S.R.)	1·4	4·9	..	..
Turkmenian S.S.R.	2·9	5·5	..	..
Tajik S.S.R.	2·2	6·8	..	0·1
Kirghiz S.S.R.	2·3	4·8	..	..
Kara-Kalpakian A.S.S.R.	10·0	..	..	..
Undistributed	0·2	..	..	..
U.S.S.R.	951·5	21·5	100·0 55 mlns. cm.	100·0 170 mlns. cm.

* Including Kalinin Province. † Including Omsk Province.
‡ Including Krasnoyarsk Province.

09.4 : 33 (79.4). GRUENEWALD, F. A. **Preliminary statement of production of lumber, lath, and shingles in California, 1938.** *Tech. Note California For. & Range Exp. Sta.* No. 12. 1939. pp. 2.

09.4 (79.5 : 79.7). *For. Res. Notes Pacific North-west For. Exp. Sta.* Nos. 13, 17, 22, 24, and 25. 1934–8.

Data on the forest resources and forest products of the North Pacific Region (Washington and Oregon).

09.4 : 33.32. KELLOGG, R. S. **The international movement of pulpwood.** *Woodlands Rev.* 10 (11), 1939 (6).

Summary of information on the imports and exports of pulpwood in the principal countries

that have such trade and on the forest resources of the most important pulpwood-producing countries.

09.7. *Forest Geography. Distribution of Forests. Monographs*

09.7 (44). BUFFAULT, P. La forêt des Bertranges [**The Bertranges Forest**]. *Rev. Eaux For.* 77, 1939 (772–86). [F.]

09.7 : 12.2 (485). LINDBERG, K. Björken i Skåne. [**Birch in Skåne.**] *Skogsägaren* 15, 1939 (227–31). [Sw.]

The volume of standing Birch in Skåne is about 2,840,000 cu. m., or approximately 13 per cent. of the standing timber of all species. Much of it is of low quality owing to fungus damage, to which the trees are very susceptible, chiefly because so many of them have arisen as sprouts from old stumps. Bad racial quality also contributes to the low quality of the timber. Birch is a useful tree on soils too poor to suit more exacting species, and as a soil improver in mixture with conifers. The future aim should be to cut out all diseased trees and to replace them as soon as possible with healthy stock of good racial origin.

09.7 (492). JAGER GERLINGS, J. H. Overzicht van de voornaamste gebeurtenissen op het gebied van den boschbouw in ons land. [**Review of the most important events in the sphere of forestry in Holland.**] *Ned. Boschb.-Tijdschr.* 12, 1939 (371–82). [Du.]

09.7 : 09.4 (495–8). NEVROS. Forêts balkaniques. I. Les forêts grecques et leur exploitation. II. Les forêts en Bulgarie. III. L'industrie du bois en Roumanie. [**Balkan forests. I. The forests of Greece and their exploitation. II. The forests of Bulgaria. III. The timber industry in Rumania.**] *Rev. int. Bois* 6, 1939 (310–15). [F.]

09.7 : 23.3 : 3 (63). BRUNORI, B. Il problema forestale in Eritrea. [**The forestry problem in Eritrea.**] *Riv. for. ital.* 1, 1939 (467–77). [It.]

Notes on utilization of natural forest resources and afforestation work.

09.7 (65). SUMMERS, T. W. **Some impressions of Algerian forestry.** *Emp. For. J.* 18, 1939 (235–43).

The forests of Algeria cover 12,400 square miles, mainly on the northern Atlas range and from these to the sea. There are five principal forest zones and the dominant species are: (1) The Cork Oak (*Quercus suber*) along the coast, to an elevation of 3,000 ft. with an annual rainfall of 25 to 40 in. and high humidity. This is the most important economic species in Algeria and covers 1,740 square miles. (2) Forests of *Pinus halepensis* cover 2,600 square miles and are important as protection forests rather than for timber production. This species favours an elevation between 4,000 and 5,000 ft. and can grow with an annual precipitation as low as 15 in. (3) Forests of low, bushy *Quercus ilex* are found at elevations of 4,000 to 6,000 ft. and are used for fuel wood. (4) *Cedrus libanotica* or s.sp. *atlantica* is found at 4,000 to 5,500 ft. It can withstand severe frost and grows well with an annual rainfall of 20 in. (5) *Juniperus phoenicea* and *Pinus halepensis* are characteristic of the sand-dune zone with a high humidity and high temperature. Juniper is useful in sand-dune fixation as branches partially covered with sand form their own root systems and become separate trees.

The organization and policy of the Forest Service are discussed with particular reference to fire protection and research.

09.7 (68.1). MILLER, O. B. **The Mukusi forests of the Bechuanaland Protectorate.** *Emp. For. J.* 18, 1939 (193–201).

From a report on an area of 3,000 square miles lying between parallels 17° 30′ and 18° 45′ South and meridians 24° 10′ and 25° 10′ East. The soil is a flat or undulating sheet of loose deep sand broken occasionally by drainage channels and a basaltic rise to 500 ft. The mean annual rainfall is 25·01 in. on 61 days and a mean maximum temperature for the hottest month is 94·9° F., while frosts occur in winter.

The timber species include *Baikiaea plurijuga*, *Pterocarpus angolensis*, *Ricinodendron rautanenii*, *Entandrophragma caudatum*, *Afzelia quanzensis*, *Copaifera coleosperma* and others less important. The forests are described as deciduous woodland of open canopy with dominants 30 to 40 ft. high and a scrub and grass understorey 2 to 3 ft. high and of varying mixture and density. Forest types include (1) Mukusi (*Baikiaea plurijuga*) which is found in a variety of forms and is the climax vegetation wherever the sand sheet is of sufficient depth. It is very susceptible to fire damage. (2) Musheshe (*Burkea africana*) is found on a relatively shallow

sand and will come in after bad fires. (3) Mopani (*Copaifera mopane*) is found on the stiffer low-lying soils. This species is important as a mining timber and makes a good charcoal.

Annual grass fires, started mainly by wandering bands of natives (Masarwa), are a severe handicap to forest development.

09.7 (728.2). STEVENSON, N. S. **Forestry in British Honduras.** *Carib. For.* 1, 1939 (1–3). [E.e.span.]

09.7 (729.2). SWABEY, C. **Forestry in Jamaica.** *Carib. For.* 1, 1939 (5–6). [E. span.]

09.7 (729.5). HOLDRIDGE, L. R. **Forestry in Puerto Rico.** *Carib. For.* 1, 1939 (7–11). [E.e. span.]

09.7 (729.7). BROOKS, R. L. **Forestry in Trinidad & Tobago.** *Carib. For.* 1, 1939 (14–15). [E. span.]

09.7 (729.9). PIDDUCK, H. B. **The forests of Dominica, B.W.I.** *Carib. For.* 1, 1939 (4). [E. span.]

09.7 (729.9). WALD, E. Y. **Forestry in Santa Lucia.** *Carib. For.* 1, 1939 (12–13). [E.e. span.]

09.7 : 33.32 : 34.6 (73). TRENDELENBURG, R. Bilder aus amerikanischer Forst- und Holzwirtschaft mit besonderer Berücksichtigung der Zellstoffindustrie. [**Scenes from forestry and the timber industry in America, with particular reference to the cellulose industry.**] *Papier-fabrikant* 37, 1939 (345–52, 357–60). [G.] P.R.

A general survey. Mention is made of the so-called 'Presto logs', a recent attempt to utilize waste material from saw-mills. The residuary material is minced, dried if its moisture content exceeds 30 per cent. and condensed under 1,400 kg. or per sq. cm. pressure into logs weighing 4 kg. and having a density of 1·3. The logs are sold at $0·05 each and their use in restaurant cars, field kitchens, &c. is on the increase. 43,500 (metric) tons were produced in 1935. Machines turning out 10–11 tons of logs in 24 hours are manufactured by Messrs. Potlach Forests Inc., Lewiston, Mass.

09.7 : 09.4 : 61 (77.3–6). CUNNINGHAM, R. N. **The meaning of the Lake States Forest Survey.** *J. For.* 37, 1939 (698–700).

The Lake States are in a rather badly depleted condition as regards commercial saw timber. On the other hand, in the short time since the region has been cut over, the forest cover has restored itself fairly satisfactorily, and growth is already sufficiently good to promise the development of a productive forest resource within some 70 years provided proper cutting methods are adopted immediately.

09.70 : 9.1 : 9 (946). GRAY, H. R. **State forests of the Empire: Tasmania.** *Emp. For. J.* 18, 1939 (202–11).

A discussion of the history of forest administration and legislation in Tasmania with notes on the present distribution of the forests in concessions and as State Forests and National Parks.

1. FUNDAMENTAL NATURAL LAWS OF THE FOREST

11.1. *Atmosphere*

11.1–2 : 43 (78). GISBORNE, H. T. **Character of the 1939 fire season in Region One.** *Appl. For. Note Northern Rocky Mt. For. & Range Exp. Sta.* No. 93. 1939. pp. 3.

11.1–2 : 01. **Bibliography of Meteorological Literature, prepared by the Royal Meteorological Society with the collaboration of the Meteorological Office.** 4. 1939 (353–413). Royal Meteorological Society, 49 Cromwell Road, South Kensington, London, S.W. 7.

11.14. Precipitations. Evaporation. Humidity

11.14 (77.1). WILSON, J. D., and PATON, R. R. **Comparative evaporation rates in normal forest, open park, and cleared areas.** *Bi-m. Bull. Ohio agric. Exp. Sta.* 24, 1939 (64–9). [Ohio Agricultural Exp. Sta.]

Experiments in Ohio with white and black Livingston atmometers during the May–September periods of 1928–31. The forest consisted of White Pine or mixed hardwood second-growth stands of medium density and average amount of undergrowth. White atmometers,

which may be said to measure the evaporation due to all factors other than sunshine, showed evaporation losses in the open park and normal forest areas that were 77 and 46 per cent. respectively as great as in the open areas. The differences between the readings for the black and the white atmometers, which give values for evaporation due to sunshine, made up 29·6, 18·8, and 9·1 per cent. of the total loss from black atmometers in cleared, open park, and normal forest areas respectively.

11.14 : 11.2 : 12.2 (77.2). POTZGER, J. E. **Microclimate, evaporation stress, and epiphytic mosses.** *Bryologist* 42, 1939 (53–61).

An atmometer study was made to determine the differences in water loss through evaporation from the bark at the base of the tree and at a point 6 ft. up on the trunk. Comparisons were also made in relation to north and south exposure, upland and ravines, and two different forest conditions. It was determined that (*a*) the difference between north and south exposure by itself had little effect on water loss, (*b*) with the same exposure, the water loss at the base of the tree was consistently lower than that 6 ft. up the trunk, (*c*) at comparable locations much greater losses were recorded at upland stations than in ravines, (*d*) higher evaporation was recorded in open woods than in typical Beech-Maple forest. It appears that variations in air currents and in protection from wind are the causes of most of these differences in water loss, and furthermore that the degree of moisture controls the establishment of epiphytic moss communities on the trees in the Central Indiana region.

11.14 (77.6). SCHANTZ-HANSEN, T., and BROWN, R. M. **Variation in rainfall over short distances at the Cloquet Forest Experiment Station.** *J. For.* 37, 1939 (804–6).

The differences between the amount of monthly precipitation reaching the ground under Jack Pine stands of three different densities were not statistically significant. The stands were unthinned, moderately thinned, and heavily thinned. A check measurement of sampling differences also showed no significant variation.

11.14 (78.9). KRAUCH, H. **Analysis of a 36-year record of precipitation at Cloudcroft, New Mexico.** *Res. Note Southwestern For. & Range Exp. Sta.* No. 60. 1939. pp. 5.

11.15. Light. Insolation.

11.15 : 12.11 : 21.1 : 23.26.2. JESTER, J. R., and KRAMER, P. J. **The effect of length of day on the height growth of certain forest tree seedlings.** *J. For.* 37, 1939 (796–803).

The species Black Locust, Red Maple, and Southern Red Oak showed increased height growth when subjected to a daylight period longer than normal, both in the greenhouse and out of doors. Slash Pine responded in the greenhouse but showed no significant increase out of doors, whereas Chestnut Oak responded with an increase in height growth out of doors and a decrease (relative to normal) in the greenhouse. When subjected to continuous light in the greenhouse Black Locust, Slash Pine, Red Maple, and Chestnut Oak showed a further increase in height growth, and these species responded to a relatively short day with a significant decrease in height growth. Southern Red Oak showed no significant response to continuous light or shortened day. A significant increase in the length of growing period resulted in increase in height growth for all species except Slash Pine growing outside. Beech, Red Maple, Southern Red Oak, Black Locust, and Chestnut Oak retained their leaves for a longer time when growing under continuous and long day conditions than with normal day length. Beech, Red Pine, and Jack Pine—all northern species—made better growth with continuous day than with long day and were not successful under normal or short day conditions.

11.2. *Climate*

11.2 : 12.19 (4). RUBNER, K. Die forstlich-klimatische Einteilung Europas. [**The forest-climatic classification of Europe.**] Handbook for Climatologists, Part VII. Section of Climatic and Physiographic Research, Soil Conservation Service, Washington, D.C. 1939. pp. 22. [Translated by H. L. Eddy from original in *Z. Weltforstwirt.* 5, 1938 (422–34).]

11.2 : 12.19 (45). PHILIPPIS, A. DE. Classificazioni ed indici del clima, in rapporto alla vegetazione forestale italiana. [**Classification and indices of climate, with reference to the forest vegetation of Italy.**] Handbook for Climatologists, Part VI. Section of Climatic and Physiographic Research, Soil Conservation Service, Washington, D.C. 1939. pp. 161. [Translated by F. Vincent and A. Chiera from original in *Nuovo Giornale Botanico Italiano* [*n.s.*] 44, 1937 (1–169).]

11.4. *Soil*

11.4 : 23.3 : 12.2 (498). CHIRIȚĂ, C. D., and BĂLĂNICĂ, T. P. Cercetări asupra nisipurilor din Sudul Olteniei. [**Research on the sandy region of South Oltenia.**] *Anal. Inst. Cerc. Exp. for.* Ser. 1, Vol. 4, 1938 [1939] (77–184). [Rum.g.]

Soil-ecological investigations in areas that were formerly shifting inland sands and are now fixed after afforestation with *Robinia pseudoacacia*; there is no evidence of soil impoverishment through the cultivation of this species, such as has been reported in Hungary by Feher.

11.4 (73). U.S.A. **Soils of the United States.** *U.S. Dep. Agric. Soils Yearbook Separate* No. 1665. 1939. pp. 1019–161. U.S. Govt. Printing Office, Washington, D.C.

11.41. Soil Physics

11.41 (498). CHIRIȚĂ, C. D. Cercetări asupra umidității solurilor forestiere, în regiunea de câmpie. [**Research on the moisture of forest soils in the Rumanian plain.**] *Anal. Inst. Cerc. Exp. for.* Ser. 1, Vol. 4, 1938 [1939] (57–76). [Rum.g.]

Facts determined from investigations made during the vegetation period of 1934, on clayey brown forest soils under both natural *Quercus cerris* and mixed broadleaved stands: (1) Soil moisture variation during the course of the vegetation period diminished with depth. At 50–60 cm. depth the variation curve was almost horizontal. (2) Throughout the period under observation the 5–10 cm. layer had the highest moisture content. Below this layer the moisture decreased (the more abruptly, the wetter the 5–10 cm. layer) and was found to be very low in the main root zone (10–20 or 20–30 cm. layer). Lower down the moisture content gradually increased again to a depth of 60 cm., below which it remained practically constant. (3) The soil was always more moist under the mixed stands than under *Q. cerris*, especially to a depth of 40 cm.

11.41 : 11.44 : 43. HEYWARD, F. **Some moisture relationships of soils from burned and unburned Longleaf Pine forests.** *Soil Sci.* 47, 1939 (313–24). [Division of Forestry, Department of Natural Resources, Atlanta, Georgia.] O.R.E.

Measurements of four paired burned and unburned Longleaf Pine forests show that in general, in the 0- to 2-in. soil layer, the 4- to 6-in. layer, and the 8- to 10-in. layer, the field moisture percentage was somewhat higher for the unburned areas than for those burned over. Soils protected from fire showed a slightly higher retention of water as determined for sifted soil from the 0- to 3-in. depth, but this was not sufficient to account for the differences in field moisture percentage. A thick mass of perennial grasses and dead plant material, forming a continuous loose mulch up to 1 ft. in depth, is found on the areas protected from fire, whereas sparse, vigorously growing ground cover, interspersed with spots of bare soil, is characteristic of the annually burned areas. The differences in moisture utilization and mulching effects of these two classes of ground cover are thought to be responsible for differences in soil moisture.

11.41 : 22.11. MALIANOV, A. P. **Modification of physical properties of the soil in forest clearings.** *Trudy Konf. Pochvoved. Fiziol., Saratov* 2, 1938 (121–36). [R.] S. and F. 2 (163).

The soil particles of forest clearings become more finely dispersed during the first years following deforestation. This reduces the permeability of the soil, thus favouring swamp formation.

11.42. Soil Chemistry

11.42. MAINZHAUSEN, L. Die polarographische Bestimmung der Alkalien und des Kalziums in den Elektroultrafiltraten basenarmer Waldböden. [**The polarographic determination of the alkalis and of calcium in electro-ultrafiltrates of base-deficient forest soils.**] *Bodenk. PflErnähr.* 14, 1939 (290–6). [G.g.] [Bodenkundliches Institut der Forstlichen Hochschule Eberswalde.] H.S.B.

According to recent investigations at the Soil Science Institute of the Eberswalde Forestry School, the polarographic method (Heyrovsky, J., and Shikata, M., The Polarograph, *Rec. Trav. chim. Pays-Bas* 44, 1925, 496 seq.) is very suitable for the quantitative determination of calcium and of potassium+sodium in electro-ultra-filtrates of base-deficient forest soils. Satisfactory results are obtained rapidly even with solutions of very low concentration (1 gramme-equivalent per 10^5–10^6 litres). Thus it was possible to detect the effects of past litter utilization in certain forest soils, where chemical analyses of HCl-extracts did not reveal an impoverishment in bases.

11.44. Soil Cover. Ground Flora. Litter. Surface Humus

11.44 (73). Shantz, H. L. **Plants as soil indicators.** *U.S. Dep. Agric. Soils Yearbook Separate* No. 1655. 1939. pp. 835–60. U.S. Govt. Printing Office, Washington, D.C.

11.44. Jacot, A. P. **Reduction of Spruce and Fir litter by minute animals.** *J. For.* 37, 1939 (858–60). [North-eastern Forest Exp. Sta.]

Spruce and Fir litter of northern Spruce woods was found to be reduced by the immature stages of three species of saprophagous mites, which eat the needles from the inside. Due to overlapping of generations, these mites feed throughout the growing season in leaves which have been softened by fungal action. A species of midge (*Sciara*) was also found within the needles but there is evidence that it may be a secondary saprophyte. Nothing is at present known of the ectophages of Spruce and Fir needles. *Author's summary.*

11.44 : 07. Skorodumov, A. S. **The determination of the thickness of forest litter.** *Lesnoe Khozyaystvo, Moscow* 1939 (12), (41–7). [R.]

A method for precise measurement and graphic representation is described.

11.44 : 11.41 : 43.1. Harkness, H. W. **On the time required for forest duff to attain hygroscopic equilibrium.** *For. Chron.* 15, 1939 (164–71).

Results from laboratory experiments, using single leaves of forest tree species, are in agreement with previous field investigations, which indicate that the duff equilibrium moisture lags behind changes in the relative humidity of the atmosphere by about 2 hours.

11.44 : 11.42. Broadfoot, W. M., and Pierre, W. M. **Forest soil studies: I. Relation of rate of decomposition of tree leaves to their acid-base balance and other chemical properties.** *Soil Sci.* 48, 1939 (329–48). [West Virginia Agricultural Exp. Sta.] O.R.E.

A study of the chemical properties of undecomposed litter of 19 tree species, the decomposition of this litter under controlled conditions, and the relationship between the chemical properties and rate of decomposition. Although content of total nitrogen, ash, calcium, and excess base may vary between samples of the same species, differences were found to be more marked between samples of different species and genera. However, values for water-soluble organic matter may vary more between samples of the same species than between those of different species.

The pH of residual material, in general, increased progressively as decomposition proceeded, and a significant relationship was determined between the excess-base content of the original litter and the pH of the residual organic matter. The variation in rate of decomposition is explained largely by variation in the chemical properties of the litter, those most closely associated with rate of decomposition being water-soluble organic matter, percentage of nitrogen, and excess-base content. Of these the first two appear to be controlling factors during the first two months of decomposition and the excess-base content is the dominant factor thereafter.

11.44 : 11.46 : 12.2. Brantsma, W. Bodemtoestand onder Amerikaanschen Eik. **[Condition of the soil under American Oak.]** *Ned. Boschb.-Tijdschr.* 12, 1939 (513–14). [Du.]

The author retracts a statement that *Quercus borealis* (*Q. rubra*) usually produces good humification. Further experience leads him to agree with Jager Gerlings that in Pine woods underplanted with this species a good crumb structure is seldom developed in the absence of other broadleaved trees, particularly *Castanea sativa*. A good crumb structure occurred, however, (*a*) in 56-year-old Pine underplanted with strips of *Q. borealis* and *Pseudotsuga taxifolia*, and (*b*) in a sowing of alternate strips of *Q. borealis* and *Larix* sp. on degraded deciduous-forest soil.

11.45. Geological Conditions

11.45–6 (73). Sims, I. H., Munns, E. N., and Auten, J. T. **Management of forest soils.** *U.S. Dep. Agric. Soils Yearbook Separate* No. 1650. 1939. pp. 737–50. U.S. Govt. Printing Office, Washington, D.C.

11.46. Relationship of Plants to the Soil

11.46–7 : 12.2 (43.1–5). Reihling, K. Bodenkundliche Untersuchung von Eichen-Jungwuchsstockungen im Revier Liebenstein der Hofkammer des Hauses Württemberg. **[Pedological investigation of retarded growth in young stands of Oak in the Liebenstein**

range of the 'Hofkammer des Hauses Württemberg'.] *Allg. Forst- u. Jagdztg.* 115, 1939 (273–91). [G.] [Bodenkundliche Abteilung der Württembergischen Forstlichen Versuchsanstalt.]

11.46 : 12.2 (498). CHIRIȚĂ, C. D. Contribuții la cunoașterea exigențelor nucului american (*Juglans nigra*) față de sol. [**Contributions to our knowledge of the demands made by *Juglans nigra* upon the soil.**] *Anal. Inst. Cerc. Exp. for.* Ser. 1, Vol. 4, 1938 [1939], (28–56). [Rum.g.]

According to preliminary Rumanian research, the essential edaphic requirements are constant humidity in the lower soil strata and medium soil texture as characterized by sandy to loamy soils.

11.46 : 12.19.2 (6). WALTER, H. Grasland, Savanne und Busch der arideren Teile Afrikas in ihrer ökologischen Bedingtheit. [**Grassland, savanna, and bush of the more arid parts of Africa as influenced by ecological conditions.**] *Jb. wiss. Bot.* 87, 1939 (750–860). [G.] S. and F. 2 (166). [Technische Hochschule, Stuttgart.]

Grassland has a deep and relatively fine-grained soil, while forest grows on stony soils such as are found on the edges of deserts. Transitional types between grassland and bush also depend on soil: thus, where a moderately thick layer of fine soil lies over uneven rock, both grass and trees may grow. Mixed vegetation may occur in Africa (unlike the northern hemisphere) on deep soils also. Parkland savanna is a special ecological type occurring where heterogeneity is high.

11.46 : 11.42–4. COILE, T. S. **Forest soil fertility: influence of stand composition on nitrogen transformation in the surface soil.** *Proc. Soil Sci. Soc. Amer.* [*1938*], 3, 1939 (225–9). S. and F. 2, 1939 (242).

Greater amounts of nitrates are formed under stands of the Red Gum–Yellow Poplar forest type than under stands of the Shortleaf Pine forest type, because in the former type the carbon-nitrogen ratio and exchangeable calcium level are more favourable for the development of nitrate-forming bacteria.

11.46 : 11.47 : 21.3. SÜCHTING, H. Untersuchungen über die Ernährungsverhältnisse des Waldes. IV. Prüfung ausgewählter Waldböden auf Nährstofflieferung durch Vegetationsversuche mit Lärche, Kiefer, und Fichte sowie auf Nährstofflöslichkeit durch chemische Untersuchungsmethoden. [**Research on the nutritional relationships of the forest. IV. Tests of selected forest soils for nutrient supply by growth experiments with Larch, Pine, and Spruce, and for nutrient solubility by chemical methods of experimentation.**] *Bodenk. PflErnähr.* 13, 1939 (73–117). [G.g.] [Institut für Bodenkunde der Forstlichen Hochschule Hann.-Münden.] H.S.B.

The fertility of 9 different forest soils and the effect on growth and nutrient absorption of separate and combined additions of Ca, K, P, and N, were investigated in vegetation experiments which differed from Neubauer's usual procedure mainly in that Larch, Pine, and Spruce were employed as test plants instead of Rye (which does not behave normally in acid forest soils), and were allowed to grow during a whole summer. Technique and results of these experiments are discussed. A distinction is drawn between 'simple' deficiency where fertilizer addition increases growth as expressed in weight but does not increase the relative amount of the nutrient contained in the plant, and 'intensified' deficiency where both growth and nutrient content are increased by manuring. In general, fertility data from the vegetation experiments corresponded well with results of chemical analyses.

11.47. Maintenance of Favourable Soil Conditions

11.47 : 11.46. JESSEN, W. Die Wirkung von Rohphosphat auf das Wachstum der Holzarten in sauren Waldböden. [**The effect of rock phosphate on the growth of tree species in acid forest soils.**] *Bodenk. PflErnähr.* 13, 1939 (249–56). [G.g.] [Institut für Forstliche Bodenkunde der Universität Göttingen, z. Zt. Hann.-Münden.] H.S.B.

In Neubauer-pot experiments with two acid soils (mortar sand and diluvial sand), raw phosphate was as effective as superphosphate or basic slag (Thomas process) in increasing the dry weight and P_2O_5-absorption of Larch seedlings. Raw phosphate had little effect when applied in combination with liming. The experiment suggests that phosphates of low solubility might find a useful application in the manuring of acid forest soils.

11.47 : 12.2. HUBERT, H. La fumure des

peupliers. [**Manuring of Poplars.**] *Potasse* 13, 1939 (58–9). [F.] S. and F. 2, 1939 [192].

Young trees responded to complete manure, gaining 10 per cent. in diameter over controls.

11.47 : 12.2. HUTCHINSON, H. P. **The manuring of Cricket-bat Willows.** *A.R. Long Ashton Res. Sta. for 1938*, 1939 (249–53). Hort. Abs. 9 (205).

Trees grown on drift loam in a non-flooding permanent meadow were supplied with sulphate of ammonia at the rate of 2 lb. to each tree. The fertilizer was applied in February, when root growth begins in this locality. The increase in timber value due to 42 lb. of the fertilizer was 4,325 cu. in. On the basis of previous values for the timber and fertilizer, 3*s*. 6*d*. worth of fertilizer produced 52*s*. 6*d*. worth of timber.

11.6. *Hydrographical Conditions including Erosion*

11.6 (47). KHARITONOV, G. A. **The rôle in water conservation of woods growing in hollows.** *Lesnoe Khozyaystvo, Moscow* 1939 (8), (33–7). [R.]

The paper is based on investigations of the Voronezh Forest Experiment Station in the Russian forest steppe. Under the prevailing conditions of undulating topography, and where the gullies are bare, up to 30 per cent. of the snow is blown from the fields into the ravines, the soil of the fields freezes to an average depth of 1 m., and up to 90 per cent. of the thawing water is discharged from the fields and overflows the rivers. Where the gullies are wooded, the snow blown from the fields accumulates on the outskirts of the woods in bands of an average width of 85 m. The soil under these bands does not freeze and is capable of absorbing the water from the melting snow which covered it and from that of the fields at higher elevations. At the same time, thawing within the woods is very slow and the total discharge is negligible. During the warm season, normal Oak gully woods on degraded chernozems of the central steppe can absorb satisfactorily the maximum flow from fields during heavy showers (15·7 litres per second per hectare during 51 minutes). The ravine woods are not quite so effective in the southern forest steppe owing to the presence of solonets soils of low permeability. Investigations in the Shipov region (southern forest steppe) in 1938 showed that where the gullies were bare the amount of solid material discharged into the rivers during the spring was 462 kg. per hectare of the catchment area. 99·5 per cent. of the material came from the gullies themselves and only 0·5 per cent. from surface erosion in the neighbouring fields. The discharge from comparable areas but with wooded ravines was only 0·16 kg. per hectare. Although in the case of the bare ravines, surface erosion significantly diminishes the thickness of the 'A' horizon in the fields, the most serious feature is the gully erosion, since 70–80 per cent. of the material from the gullies consists of particles larger than 0·01 mm., the discharge of which is a major cause of the silting-up of waterways. In the author's opinion, woods should occupy a width of 35–60 m. on each side of the ravines and care should be taken to conserve litter and undergrowth. In the Russian forest-steppe region gullies occur on the average at intervals of 600–800 m.

11.6 (47). TROITSKI, V. A. **Planning forest distribution in the water conservation zone.** *Lesnoe Khozyaystvo, Moscow* 1939 (10), (4–14). [R.r.]

The present state of knowledge on this subject, with special reference to European Russia.

11.6 : 42.3 : 96 (729.7). CATER, J. C. **Deforestation and soil erosion in Trinidad: deforestation and soil erosion in the foothills of the Northern Range caused by shifting cultivation.** *Trop. Agric., Trin.* 16, 1939 (230–2).

The most drastic and probably the most effective measure to reduce soil erosion and flooding in the region in question would be the prohibition of shifting cultivation above the 300 ft. contour, allowing the land to revert to forest. To compensate for the loss of some thousands of acres of land to cultivation, the large areas of abandoned or almost worthless Cacao plantations, which exist in the Colony and which can be profitably replaced by a mixed animal and vegetable crop husbandry, could be given to the cultivators. There are also large areas of derelict land throughout the Colony where, in spite of the low fertility of the soils, crops of vegetables could be raised under a system of controlled shifting cultivation.

11.6 : 96 (74). CLINE, A. C. **The restoration of watershed forests in the hurricane area.** *J. New Engl. Wat. Wks. Ass.* 53, 1939 (223–37). [Harvard Forest, Petersham, Mass.]

Selection forest of all ages and sizes is the form most suitable for watershed management, and hardwoods seem better adapted than conifers to meet the needs of watershed protection in Southern New England. Young coniferous stands that are wind-thrown should be replaced by mixtures of species that are mutually beneficial.

11.6 : 42.3 (75.7). IRELAND, H. A., SHARPE, C. F. S., and EARGLE, D. H. **Principles of gully erosion in the Piedmont of South Carolina.** *Tech. Bull. U.S. Dep. Agric.* No. 633. 1939. pp. 142.

11.6 : 91 (79.1). SYKES, G. G. **The relation of infiltration to stream flow on a south-western mountain watershed.** *Res. Note Southwestern For. & Range Exp. Sta.* No. 41. 1938. pp. 3.

Studies on mountainous parts of the Salt River watershed show that most of the annual run-off is ground-water run-off, particularly where there is a good ground cover of vegetation, and that it results mainly from winter precipitation. A hydrograph for an experimental watershed is described, on which rainfall intensity is plotted in inches per hour and stream flow in inches of depth on the watershed.

11.6 : 12.19.2 : 96 : 97.1 (931). NEW ZEALAND. **Maintenance of vegetative cover in New Zealand, with special reference to land erosion.** [Report of Committee of Inquiry.] *N.Z. D.S.I.R. Bull.* No. 77. Govt. Printer, Wellington, New Zealand. 1939. pp. 51.

This paper discusses the main types of vegetational cover, erosion, and river flooding under both primitive and present-day conditions, and the restoration and maintenance of a stable vegetational cover as a means of controlling erosion. In the Committee's opinion, New Zealand already possesses the required minimum acreage of forest and shrubland for erosion control, but the distribution is faulty and, as a whole, it is inadequately protected. It is recommended that—

'Statutory and administrative measures should be taken at the earliest opportunity to inaugurate a programme to handle the serious soil-erosion, soil-conservation, and land-utilization problems that now face us. In such a programme the most effective factor will be the preservation and establishment of a stable vegetative cover in which forest land, shrubland, and grassland have most important parts. Further, such a programme should include the active collaboration and co-operation of foresters, agrostologists, botanists, agriculturists, engineers, and soil technologists.'

11.6 : 42.3 (97). **A review of the position in regard to soil conservation in the Colonial Empire in 1938.** Colonial Office. 1939. pp. 83.

11.6 : 91. NEWMAN, F. S. **The forest and its effect on stream-flow.** *For. Chron.* 15, 1939 (200–6). [Ontario Forestry Branch, St. Williams, Ontario.]

The effects of forests on stream flow are summarized. Tree species that can be used in planting steep slopes and gullies in this region are classified according to the soil conditions to which they are best suited.

11.6 : 91 : 07. HERTZLER, R. A. **Engineering aspects of the influence of forests on mountain streams.** *Civ. Engng., Easton, Pa.* 9, 1939 (487–9). [Appalachian Forest Exp. Sta., Asheville, N.C.] L.S.

Brief descriptions are given of new devices for measuring stream flow and silting. Investigations of sample plots and small drainage areas indicate that for 10 per cent. frequency of all storms over ½ in. of rain, the run-off from abandoned farmland, over-grazed pasture, and denuded lands, may be respectively 12, 24, and 47 times that from forested lands, considering the latter as unity. Hydrograph analysis and field observations of storm factors indicate that the infiltration capacity of deep forest soils, which are undisturbed, is very high.

12. TREE SPECIES. FOREST BOTANY.

12.11. Physiology. Biology [including Genetics]

12.11 : 07 (485). Inventering av de svenska skogsträden: en första punkt på Föreningens för växtförädling av skogsträd arbetsprogram. **[Taking stock of the forest trees of Sweden: an initial feature in the programme of the Swedish Tree-Breeding Association.]** *Skogen* 26, 1939 (404–5). [Sw.]

The Swedish Tree-Breeding Association [*For. Abs.* 1 (139)] proposes to make an inventory of Swedish timber trees, in order to locate and secure suitable material for breeding. Reconnaissance trips have already shown that such an inventory will be extremely valuable.

12.11 (71.4). Riou, P., and Delorme, G. De la répartition du manganèse et du fer dans les principaux arbres à feuilles caduques du Québec. **[On the distribution of manganese and iron in the principal deciduous trees of Quebec.]** *C.R. Acad. Sci. Paris* 208, 1939 (1671–3). [F.] P.R.

Betula spp., *Ostrya virginiana*, and *Populus* spp. have been examined to complete a study of iron and manganese in the principal broad-leaved trees of Quebec. *Betula* spp. and *Ostrya virginiana*, which occur chiefly on acid soils, had high manganese and comparatively low iron contents; *O. virginiana* had higher ash, iron, and manganese contents than the Birches. The Poplars, also found mainly on acid soils, contained comparatively little manganese. The results of the general investigation are summarized. Iron and manganese were found in all the species examined; they were contained in all parts of the trees, though the wood of Ashes, Elms, and *Acer negundo* showed only traces and in some instances failed to show manganese. In general, the content of manganese and iron decreased in the following order: leaves, bark, branches, trunkwood. Iron content varied little from genus to genus, but manganese showed a wide range and some specificity. Calcareous soils appeared to inhibit manganese assimilation, though acid soils did not necessarily favour it in all cases (cf. Poplars). In manganese and iron contents *Acer negundo* resembled Ash.

12.11 : 12.2 (74.7). Littlefield, E. W. **Height growth of Scotch Pine from different seed sources.** *Notes For. Invest.* No. 23. 1939. pp. 2.

Periodic measurements, over 5 years, of small parallel plantings of various racial types of Scotch Pine showed marked differences in height growth. Seedlings or transplants of Belgian origin showed a relatively fast growth rate, whereas stock of Baltic origin (i.e. 'Riga') was slowest. Vigorous 2–2 stock from Bessey, Nebraska (1925 seed from 1903–4 plantation) made the fastest growth, and 'H.B. Special' stock from a certified stand near Magdeburg, Germany, is probably of a fast-growing type. Growth figures are also given for stock of seed from Czechoslovakia, Boonville, N.Y., and Lewis, N.Y.

12.11. Gut, R. C. Assimilation chlorophyllienne avant le lever du soleil. **[Assimilation by the chlorophyll before sunrise.]** *J. for. suisse* 90, 1939 (251–8). [F.]

According to observations made during clear weather on 3rd July 1939 in a Spruce stand situated at 1,420 m. above sea-level in the Ormont valley, Switzerland, photosynthesis commenced at 2 a.m. The concentration of CO_2 at 20 m. above soil (stand height 30 m.) diminished rapidly until 3 a.m. and in the course of the day it never fell below the figure already attained at 4 a.m., i.e. 1½ hours before sunrise. The earliness of photosynthesis is ascribed to ultra-violet rays. From this and former investigations by the same author, the conclusion is drawn that during clear weather in June and July photosynthesis in conifer stands commences as early as 2 a.m.

12.11. Johnson, L. P. V. **The breeding of forest trees.** *For. Chron.* 15, 1939 (139–51).

A discussion of tree breeding as a means of improving forest stock and thus contributing to cultural forestry. Consideration is given to methods for shortening the time element in tree breeding, and a tentative programme for tree improvement is outlined.

12.11. Macdougal, D. T. **Features of growth-control in trees.** *Proc. Amer. phil. Soc.* 81, 1939 (421–45). [Desert Laboratory, Carnegie Institution of Washington.] L.S.

Results from defoliation and disbudding tests indicate that auxins which may promote growth of cambium or secondary meristem and inhibit growth of primary meristem in buds may originate in buds and leaves, and that initial activity in the primary meristem of the lateral buds is controlled by the inhibiting action of auxins from the terminal buds. With the removal of the terminal buds, the inhibiting action of their products on laterals may cease, though without disturbing cambium activity. Defoliation, which is followed by some awakening of axillary buds, has a very positive detrimental effect on wood formation by the cambium. As growth begins simultaneously through the length of tall trunks, the conclusion that auxins or their activating effects are transmitted downward immediately after production in leaves and buds is untenable. The inception of cambial activity in trunks may precede growth in buds or dependent segments of twigs in some deciduous and evergreen trees, and the presence of favourable environmental factors may determine the start of the growth-promoting action.

Apical growth and cambial thickening in

roots may precede similar action in shoots or trunks by weeks, and it is highly improbable that growth-promoting substances originating in stem terminals are concerned in the growth of roots except in the basal sections. *From author's summary.*

12.11 : 11.11. HANDLEY, W. R. C. **The effect of prolonged chilling on water movement and radial growth in trees.** *Ann. Bot., Lond.* [*n.s.*] 3, 1939 (803–13). O.B.D.

Radial growth in woody shoots of young plants of *Fraxinus excelsior* and *Acer pseudoplatanus* was almost completely inhibited by continuous cooling to about 2° C. during the growing season. Longitudinal shoot growth continued, though it started later and was slower than in the controls. If the temperature was lowered from 2° C. to 0° C., water conduction was impeded to such an extent that the leafy shoots wilted, but turgidity was restored when the temperature was again raised to 2° C. The wilting effect is considered to lend support to the view that living cells of the wood are actively involved in the ascent of sap.

12.11 : 11.15 : 21.1. SHCHEPOTIEV, F. L. **Growth of woody plants as affected by curtailed day length.** *C.R. Acad. Sci. U.R.S.S.* 23, 1939 (722–5). [E.] [Section of Physiology, Ukrainian Institute of Soil Reclamation Forestry, Kharkov.] O.R.S.

Seedlings of *Ailanthus glandulosa* and *Morus alba*, raised at Kharkov in 1935, were subjected soon after their appearance above ground to short photoperiods of 6 and 9 hours daily for a single period of days varying between 5 and 105. At the end of this and the succeeding growing seasons of 1936 and 1938 their height growth was measured, and in 1938 weighings were made of 500 leaves from each series. It was found that a single curtailed-day treatment, lasting for 5 or 10 days with a daily light period of 6 or 9 hours, was capable of increasing stem elongation and leaf weight by 50–100 per cent. as compared with controls. This effect was as marked at the end of the fourth year as it was at that of the first. Short-term curtailed-day-light treatment thus stimulated growth, both in this and in the succeeding seasons. It is suggested that short-term photoperiodic treatment should be elaborated for growing woody species in nurseries.

12.11 : 11.15 : 21.5. MOSHKOV, B. S., and KOCHERZHENKO, I. E. **Rooting of woody cuttings as dependent upon photoperiodic condition.** *C.R. Acad. Sci. U.R.S.S.* 24, 1939 (392–5). [E.] [All-Union Institute of Plant Industry, Pushkin.] O.R.S.

Preliminary experiments showed that in 3 species of Willow the highest percentage of rooted cuttings was obtained with the following treatments: (*a*) *Salix undulata*—parent and cuttings both given long 18-hour days; (*b*) *S. babylonica*—parent given 14-hour days, cuttings 18-hour days; (*c*) *S. pierotti*—parent and cuttings both given 10-hour days. In later experiments most of the species examined, especially those of northern origin, rooted best when the cuttings received continuous illumination. Cuttings from parent plants of *S. undulata* grown with short 10-hour days rooted only when given continuous illumination, which had to be applied at once to be effective. Cuttings from short-day parents had more vigorous root and shoot development than controls. When cuttings were taken every 5–10 days from northern species of Willow and Black Currant, those from the short-day parents were the first to root; after a certain time of year, however, cuttings from short-day plants failed entirely to root, though those from southern species kept under the same conditions rooted throughout the growing season. *Salix viminalis* and *S. undulata*, which have much the same geographical range, exhibited differences in photoperiodic behaviour. Controls of *S. viminalis* grown with natural daylight gave 100 per cent. rooting at all times between 25th July and 5th November; while those of *S. undulata* gave 100 per cent. rooting till 5th September, after which rooting dropped rapidly to nil by 10th October, subsequently rising again to 100 per cent. by 25th October. Short-day treatment of the parents emphasized these differences.

The authors' general interpretation of the results of their experiments is that the photoperiodic conditions experienced by the parent plant govern the ability of cuttings to strike root by means of their influence on growth processes and the incidence of summer dormancy, as exemplified in the experiment on *S. viminalis* and *S. undulata*. Thus southern species grown under northern light conditions fail to reach the physiological state necessary for optimum rooting of cuttings unless they are grown with short photoperiods.

12.11 : 12.14 : 12.2. WAGENKNECHT, E. Untersuchungen über den Spiegelrindenanteil ver-

schiedener Kiefernrassen im Zusammenhang mit der Ästigkeit. [**Research on the proportion of smooth bark in various races of Scots Pine in relation to branchiness.**] *Z. Forst- u. Jagdw.* 71, 1939 (505–26). [G.g.] [Waldbauinstitut (Möller-Institut) der Forstlichen Hochschule Eberswalde.]

Northern and eastern geographic races (seed origin: Latvia, Belgium, East Prussia) had a larger proportion of smooth bark than more southern and western races (seed origin: Brandenburg, Palatinate, Inverness-shire, Haute Loire). The absolute height to which the rough bark reaches as well as its relative height in proportion to total tree height, increased in all races, independent of age, with the diameter of the trees. In general, branchiness decreased as the proportion of smooth bark increased, and also with decrease of diameter in even-aged stands. With a few exceptions, the increment of the last 50 years was greater under rough than under smooth bark.

12.11 : 12.15 : 12.2. Jager Gerlings, J. H., Smit, J. F., and Soest, J. van. Herkomstonderzoek van den Douglasspar aan de Afdeeling Houtteelt van het Instituut voor Boschbouwkundig Onderzoek. [**Research by the Silvicultural Department of the Forestry Research Institute on the provenance of Douglas Fir.**] *Ned. Boschb.-Tijdschr.* 12, 1939 (405–32). [Du.]

An account is given of the natural distribution, habitat factors, and main varieties of Douglas Fir. Investigations on seed origin in relation to growth and susceptibility to damage were initiated in Holland in 1923. Numerous experimental plots have been set up, but since the oldest trees are only 15 years old (sown in 1924) and the youngest only 7 years old (sown in 1932), no definite results can be given as yet. As compared with '*caesia*' races, the '*viridis*' races seem to grow faster and suffer less from loss of the leading shoot, and to be more resistant to *Rhabdocline* but less so to *Phomopsis*. Many '*viridis*' races are attacked by *Chermes* without any noticeable effect on their growth. There is also some slight indication that '*viridis*' races may be less susceptible to frost damage. The source of seed and the results hitherto obtained from each lot are presented in tabular and graphic form.

12.11 : 12.15. Lantelmé. Zur Zwangsfruktifikation bei unsern Waldbäumen. [**On 'forced fruiting' in our forest trees.**] *Allg. Forst- u. Jagdztg.* 115, 1939 (335–42). [G.]

The numerous horticultural methods of producing 'forced fruiting' are reviewed, and it is suggested that such methods should be tested in forestry, where they might find a useful application both in practical silviculture and in scientific breeding work.

12.11 : 12.2. Dengler, A. Über die Entwicklung künstlicher Kiefernkreuzungen. [**On the development of artificial Pine hybrids.**] *Z. Forst- u. Jagdw.* 71, 1939 (457–85). [G.g.] [Waldbau-Institut (Möller-Institut), Eberswalde.]

Observation on 9- to 10-year-old Pines resulting from cross-pollination within, or hybridization of, several geographic races grown in Chorin, revealed distinct heterosis in Scotch ♀, × Brandenburg ♂, and better growth in French ♀ × Brandenburg ♂ than in the pure maternal line, while Palatinate ♀ × Brandenburg ♂ and Scotch ♀ × East Russian (Perm.) ♂ did not differ in growth from the pure maternal line. Bad stem form in Palatinate Pine did not improve by hybridization with Brandenburg Pine. The bluish needle colour of the French and the yellowish winter colour of the East Russian appeared in hybrids of French and East Russian maternal parentage respectively, and the yellowish colour also appeared in Scotch ♀ × East Russian ♂. Self-pollination in *montana* and *sylvestris* gave a degenerated descendance in many cases. It was not possible to cross *banksiana* and *sylvestris*, but mutual hybridization was obtained with *montana* and *sylvestris*. The hybrids had the same type of needles and behaved in the same manner towards needle-cast as pure *sylvestris*, but their general growth form ranged from typical *montana* shrub to almost pure *sylvestris*.

12.11 : 12.2. Dillewijn, C. van. Cytologie en veredeling van *Populus*. [**Cytology and breeding of *Populus*.**] *Ned. Boschb.-Tijdschr.* 12, 1939 (470–81). [Du.e.]

Preliminary report on cytological investigations on *P. nigra* L.; *P. nigra* L. var. *italica* du Roi, *P. brabantica* Houtz., *P. gelrica* Houtz., *P. robusta* Schneid., *P. deltoides* Marsh. var. *missouriensis* Henry, *P. serotina* Hartig, and *P. alba* L. *P. nigra*, which is generally considered a pure species, showed, like its variety *italica*, a regular heterotypic and homotypic division. *P. brabantica*, *P. gelrica*, *P. robusta*,

and *P. serotina* showed various irregularities characteristic of hybrids. The great number of irregularities which was observed in *P. deltoides* var. *missouriensis* confirmed the view held by some authors that this variety is a hybrid. The specimen of *P. alba* examined proved to be triploid. Secondary association occurred clearly in *P. nigra* and its variety *italica*, and less clearly in the hybrids. In the author's opinion, the genus *Populus* (and possibly also *Salix*) is a secondary polyploid with an original basic number of $n = 8$; of these, 4 chromosomes have been triplicated and the remaining 4 duplicated. The present number of 19 was the result of a fusion of 2 chromosomes within one of the groups of three.

12.11 : 12.2. LITTLE, E. L. **The earliest stages of Pinon cones.** *Res. Note Southwestern For. & Range Exp. Sta.* No. 46. 1938. pp. 3.

Three growing seasons are required for the formation and maturation of the cones of *Pinus edulis*. The distinguishing characteristics of the primordia of ovulate cones and of spur shoots are described, and the possibility of estimating the cone crop on trees or small areas is discussed.

12.11 : 12.2. WETTSTEIN, W. VON, and PROPACH, H. Sichtungsarbeit zur Birkenzüchtung. [**Reconnaissance work in Birch breeding.**] *Züchter* 11, 1939 (279–80). [G.] C.G.B.

The chromosome number has been found to be a useful guide in the systematic determination of a specimen, *Betula verrucosa* for instance having $2n = 28$, *B. pubescens* $2n = 56$. Some trees classed as *B. pubescens* on account of their high quality for veneer production have proved on cytological examination to belong to *B. verrucosa*, a species previously regarded as inferior for this purpose.

Natural hybrids between the two species have been found among seeds from both. One seedling of *B. verrucosa* had $2n = 46$–52 and it is thought to have arisen by pollination from a triploid hybrid.

A study of the economic value of the hybrids is to be made.

12.11 : 23.23.1 : 12.2. BROWN, J. W. **Respiration of acorns as related to temperature and after-ripening.** *Plant Physiol.* 14, 1939 (621–45). [School of Forestry, Duke University, Durham, N.C.] O.B.D.

Acorns of the White Oak group germinate as soon as they fall, but those of the Red Oaks must first undergo a period of after-ripening. In view of this phenomenon, respiration, catalase activity, and germination were studied in acorns of *Q. alba* L. and *Q. borealis* var. *maxima* (Marsh) Ashe. The results, which show no striking difference between the species in respiratory activity during storage, are discussed from the physiological point of view. Germination tests with acorns of *Q. borealis* var. *maxima* showed that, within the range of 0°–20° C., storage temperatures of 10° and 12·5° C. resulted in the highest germination per cent., and that in this species the acorns giving the highest percentage of germination had a respiratory quotient during storage of less than 0·3.

12.11 : 23.23.1 : 12.2. SHUNK, I. V. **Oxygen requirements for germination of seeds of *Nyssa aquatica*—Tupelo Gum.** *Science* 90, 1939 (565–6). [N.C. State College of the University of North Carolina.]

'Seeds' [seeds plus endocarp] of *Nyssa aquatica* failed to germinate when flooded with water; in moist, well-aerated sand, however, a fair percentage germinated. It would seem, therefore, that the tree cannot invade areas that are constantly flooded.

12.11 : 23.26.5 : 21.5 : 12.2. SNOW, A. G. **Clonal variation in rooting response of Red Maple cuttings.** *Tech. Note Northeastern For. Exp. Sta.* No. 29. 1939. pp. 2. [New Haven.]

Controlled experiments indicate differential rooting ability of Red Maple clones, which is determined by inherent differences in either natural rooting ability or response to specific auxin applications.

12.11 : 31.1 : 11. KOEHLER, A. **Heredity versus environment in improving wood in forest trees.** *J. For.* 37, 1939 (683–7). [Forest Products Laboratory, Madison.]

The xylem of the tree is least affected by hereditary changes and so it is probable that breeding experiments should be mainly concerned with objects other than the improvement of cellular structure and chemical composition of wood itself. A list is included of the important variable features that affect the properties and usefulness of wood and they are marked as to whether they are believed to be influenced by heredity or environment.

12.12. Pathology

12.12 : 12.2 (41.5). LIESE. **The occurrence in the British Isles of the *Adelopus* disease of Douglas Fir.** *Quart. J. For.* 33, 1939 (247–52).

From observations made while on a tour in Ireland.

12.12 : 13.1 : 12.2 : 13.2 (43.8). NUNBERG, M. **A mass appearance of the Pine Sphingid, *Sphinx pinastri* L., in Poland.** *Roczn. Ochr. Rosl.* 6, 1939 (57–65). [Pol.] R.A.E. A 27 (676–7).

Details of an outbreak in 1935–7 in north-western Poland, together with notes on the bionomics of the moth.

12.12 : 12.2 (47). ANKUDINOV, A. M. **Heart rot in Aspen.** *Lesnoe Khozyaystvo, Moscow* 1939 (8), (43–9). [R.]

In pure-culture experiments at the All-Union Forestry Research Institute (Vniilkh), it was not possible to isolate *Fomes igniarius* from wood specimens showing discoloration from rose to brown, but in which no heart rot was as yet evident. From this it is concluded that discoloration cannot be regarded as the first stage of heart rot. Further research confirmed the view that discoloration in seedlings of less than 3 years of age is caused in the first place by mechanical injury of the stem, while in older trees both discoloration and heart rot are related to dead branch stubs and unhealed wounds where the stubs are broken off. The degree of damage caused by heart rot in Aspen varies in the different parts of Russia according to site conditions.

12.12 (47.2). DUDINA, V. S. **Pine disease caused by *Cenangium abietis* R.** *Lesnoe Khozyaystvo, Moscow* 1939 (10), (52–6). [R.]

A description of the disease based mainly on observations in the Northern Cossack Territory.

12.12 : 13.1 : 13.2 (47.3). AVERKIEV, I. S. **The study of the gypsy moth in the forests of the Central Volga provinces.** *Lesnoe Khozyaystvo, Moscow* 1939 (11), (50–2). [R.]

Notes on biology and natural enemies of *Porthetria dispar*; since 1930 serious damage has been reported over wide regions. In years of mass attack the girth increment of Oak, Birch, Lime, and Elm is lowered by as much as 42–55 per cent.

12.12 : 11.12 : 13.2 (485). TRÄGÅRDH, I. **[The spring storm and the insect menace in upper Norrland.]** *Skogen* 26, 1939 (478–81). [Sw.]

On 1st May 1939 a heavy gale seriously damaged Pine forests in Nedre Norrbotten and Skellefteå, throwing 430,000 trees in the former and 320,000 in the latter region. The worst damage occurred where stands had recently been cut over and where the frozen ground had only just thawed. It was proposed to leave most of the timber in the woods until autumn, owing to the risk of checking and sap stain in summer conversion and because previous experience suggested that many of the trees might retain enough root connexion to keep them sound over the summer. An entomological inspection was made on 6–8th July. *Blastophagus piniperda* was absent, since its breeding season was over before the storm. *Ips sexdentatus* occurred in the lowest 3–4 m. of the trunks, generally in company with *I.* (*Orthotomicus*) *proximus*, which infested the next highest portion, while *I. acuminatus* was confined to the thin-barked upper region of the trunk and the branches. Only a few egg galleries and newly hatched larvae of *Acanthocinus aedilis* were observed. *Monochamus sutor* was not found, but since it breeds later it was expected to occur before the autumn.

The results of the inspection were so favourable that the timber was left until September. Meanwhile, a second inspection was made on 24–27th August. The beetles then occurring were *M. sutor*, *I. sexdentatus*, *I. proximus*, and *I. acuminatus*. Of 161 trees examined 102 still had green crowns, 10 were half withered, and 54 were completely or almost completely so. Six of the green-crowned trees had been attacked, 5 of them by either *M. sutor*, *I. sexdentatus*, or both; the remaining one had suffered an abortive attack by *I. sexdentatus* and *I. proximus*. Of the trees with half-withered crowns one had been attacked by *M. sutor* and one by *I. sexdentatus*. The fully withered trees were all attacked. Damage by *I. acuminatus* and *I. proximus* is not very serious, as only the upper and less valuable parts of the tree are affected. *M. sutor* and *I. sexdentatus*, however, attack the lowest 6–8 m. of the trunk, i.e. the most valuable part. Examination showed that in 84·3 per cent. of stems attacked by the former, the infestation was as yet limited to the bark, and damage could be avoided by barking. To eliminate damage by *I. sexdentatus*, it would have been necessary to bark the infested stems

before the end of July, on account of the beetle's earlier breeding season, but this was impracticable, since the infested stems were too thinly distributed over the area to make the operation profitable.

12.12 : 13.2 (489). THOMSEN, M. Angreb af *Tomicus chalcographus* paa unge Sitkagraner, Rødgraner, og Douglasgraner. [**Attack of *T. chalcographus* on young Sitka Spruce, Norway Spruce, and Douglas Fir.**] *Forstl. Forsøgsv. Danm.* 15, 1939 (199–208). [Da.e.]

In 1936, and especially in 1938, many young stands of Sitka and Norway Spruce were heavily damaged by the insect. The primary cause was probably spring frost injury to the cambium, but there was evidence that most of the young trees did not succumb to the direct effect of the frost. In some places even Douglas Fir was attacked by the beetle, though this tree was evidently more often killed by the frost alone. This is the first time that Douglas Fir has been recorded as a host plant of *T. chalcographus*.

12.12 : 13.1 : 13.2 : 12.2 (7). BALCH, R. E. **The outbreak of the European Spruce Sawfly in Canada and some important features of its bionomics.** *J. econ. Ent.* 32, 1939 (412–18). R.A.E. A 27 (647–8).

A detailed account is given of the biology of *Diprion polytomum* Htg., with special reference to future attacks on Spruce forests in Canada and the north-eastern United States. The present distribution of the insect and the damage caused by its attacks are described. Species of Spruce attacked are *Picea glauca*, *P. rubra*, *P. mariana*, *P. abies* (*excelsa*), *P. pungens*, and *P. sitchensis*. Some preference is shown for *P. glauca*, both for oviposition and feeding. Damage to the trees, which consists in mortality or loss of vigour, is confined to heavily infested areas; death of the trees has so far occurred almost exclusively in the Gaspé peninsula. The sawfly is well adapted to the environmental conditions of Canadian Spruce forests and has no effective natural enemies there. Severely infested areas are likely to increase, but since the dislike of the larvae for new foliage usually saves the trees from a rapid death, there is hope that the introduction of effective parasites will eventually prove a satisfactory control.

12.12 : 13.1 : 12.2 : 13.2 (7). GRISWOLD, C. L. **Introduced Pine sawfly.** *J. econ. Ent.* 32, 1939 (467–8). R.A.E. A 27 (651).

An account of the biology, distribution, and history of *Acantholyda erythrocephala* L. in N. America. First found in Pennsylvania in 1925, it has now extended its range to New York and New Jersey. The larvae feed in America on *Pinus resinosa*, *P. strobus*, *P. mugo*, *P. sylvestris*, *P. densiflora*, and *P. nigra* var. *austriaca*, the first two species being the most favoured and the last one the least. Although it attacks Larch, Spruce, and Silver Fir in Europe, no damage to these species has been observed in America.

12.12 (7). HEDGCOCK, G. G. **Notes on North American Pine-Oak species of *Cronartium* on *Castanea*, *Castanopsis*, and *Lithocarpus*.** *Phytopathology* 29, 1939 (998–1000). [Bureau of Plant Industry, U.S.D.A.]

Tabulated results of inoculations of species of *Castanea*, *Castanopsis*, and *Lithocarpus* with aeciospores and urediospores of *Cronartium cerebrum*, *C. conigenum*, *C. fusiforme* Hedge and Long, *C. strobilinum*, and the urediospores of *C.* sp., a species found on the leaves of evergreen oaks in California and without a known aecial stage. In all the reported infections, uredia, telia, or both resulted from the infection; control plants were not infected.

12.12 : 12.2 (71.1 : 79.6). CHILDS, T. W., and KIMMEY, J. W. **Studies on probable damage by blister rust in some representative stands of young Western White Pine.** *J. agric. Res.* 57, 1938 (557–68). Repr. [U.S. Forest Pathology Field Laboratory, Portland, Oregon.]

From investigations on several areas in British Columbia and Idaho it was found that the percentage of cankers capable of doing damage ranged from 100 in the smallest trees to less than 30 in trees 45–50 ft. high, but in the same stand the larger trees were much more heavily infected than the smaller ones. It is estimated that young stands exposed to even moderately severe infection will be practically destroyed before reaching commercial maturity.

12.12 : 12.2 (729.5). GARCIA, L. A. ALVAREZ. **A Mahogany seedling blight in Puerto Rico.** *Carib. For.* 1, 1939 (23–4). [E.e. span.] [Agricultural Exp. Sta., Río Piedras, Puerto Rico.]

A foliage blight, followed by defoliation of 6-months-old seedlings of *Swietenia mahagoni* Jacq., was found to be caused by a fungus of the Sphaeropsidales. The causal agent is

described as a new species, *Phyllosticta swieteniae* sp. nov. The development of the disease is favoured by the crowding of large seedlings, artificial shade, and high humidity, while seedlings grown in the open are relatively free from infection.

12.12 : 13.2 (74.2). BALDWIN, H. I. **The European Spruce sawfly in New Hampshire, 1938.** *J. For.* 37, 1939 (876–8).

The European Spruce sawfly (*Diprion polytomum*) is thoroughly established in New Hampshire. An estimated 5 million board feet of Spruce is expected to die in 3 to 5 years as a result of defoliation by this insect. A report on the work undertaken on this problem during 1938.

12.12 : 12.2 (77.4–6). DAVIS, W. C., YOUNG, G. Y., and ORR, L. W. **Needle droop of Pine.** *J. For.* 37, 1939 (884–7).

Abnormal drooping of the needles of the current year's growth of Red Pine (*Pinus resinosa*) and occasionally of White Pine (*P. strobus*) was observed in Minnesota, Wisconsin, and Michigan in 1935, particularly on plantation stock up to 20 ft. high. The needles were bent over at a point about ¼ in. from the base. The injury to the affected tree varied greatly. This condition was subsequently observed in nurseries in Maryland and Wisconsin, in a Massachusetts plantation, and on *P. ponderosa* in the north-western states. The cause has not as yet been determined, but it may possibly be some abnormal physiological condition, particularly as exceptionally rapid needle growth preceded the injury recorded in 1935. Frost appears to be responsible for the damage in some cases.

12.12 : 11.11 : 12.2 (77.6 : 78.3). **A fast-growing and winter-hardy Poplar still to be found for the Lake States.** *Tech. Note Lake States For. Exp. Sta.* No. 153. 1939. p. 1.

Ten of the fast-growing Poplar hybrids bred by the New York Botanic Garden and the Oxford Paper Company have been tested for four years in Minnesota and North Dakota. All have proved susceptible to frost damage, the most resistant hybrid, *P. berolinensis* ♂ × *angulata* ♀, showing only 58 per cent. survival.

12.12 (79.4). ARK, P. A. **Bacterial leaf spot of Maple.** *Phytopathology* 29, 1939 (968–70). [University of California, Berkeley, Cal.]

Phytomonas aceris n.sp. was first noted in Berkeley, California, in 1937, on seedlings of *Acer macrophyllum*, early in the spring during cool, damp weather. *A. circinatum*, *A. negundo*, *A. negundo* var. *californicum*, and *A. palmatum* are also susceptible.

12.12 : 11.14. **Comparative resistance of native Wisconsin trees to snow breakage.** *Tech. Note Lake States For. Exp. Sta.* No. 152. 1939. pp. 1.

The species Black Spruce, Tamarack, White Cedar, Balsam Fir, and White Birch showed an average of 8 to 10 per cent. of the trees in the small size class (0 to 4·5 in. d.b.h.) uprooted or badly bent. In the largest size class (9·0 to 24.0 in. d.b.h.) White Spruce showed by far the highest damage of any species with an average of 10 per cent. stems broken. Red Pine, Hard Maple, Red Oak, and Basswood suffered practically no damage in any size class.

12.12 : 12.11 : 12.2. HAHN, G. G. **Immunity of a staminate clone of *Ribes alpinum* from *Cronartium ribicola*.** *Phytopathology* 29, 1939 (981–6).

Ribes alpinum was inoculated with *Cronartium ribicola* in 1937 and 1938. The pistillate clones became infected, while the staminate clones proved immune. The results corroborate the findings of Clinton and McCormick presented in *Conn. Agr. Exp. Sta. Bull.* 260 (475–501). 1924.

12.12 : 12.11 : 12.2. KRIJTHE, N., and WENT, J. C. Inoculaties van iepenbastaarden verricht in 1938. **[Inoculations of Elm hybrids carried out in 1938.]** *Tijdschr. PlZiekt.* 45, 1939 (71–4). [Du.] Pl. Breeding Abs. 9, 1939 (349).

Confirmation was obtained of the high percentage of susceptibility to Elm disease in seedlings with *Ulmus laevis*, *U. glabra*, or *U. glabra minor* as the female parent. An attempt was made to classify the hybrids according to leaf shape and habit of growth, and some evidence was obtained which suggests that *U. hollandica superba* forms may be derived from crosses containing *U. glabra*. *U. hollandica belgica*, however, produced no hybrids of the *U. glabra* type. In general a clear relation was found to exist between the type of the hybrids and their susceptibility to the disease.

12.12 : 12.2. CAMPBELL, W. A. ***Daedalea unicolor* decay and associated cankers of Maples and other hardwoods.** *J. For.* 37,

1939 (974–6). [Bureau of Plant Industry, U.S. D.A.]

This fungus is particularly important on Red and Sugar Maple of sprout origin, and in this respect appears to be parasitic as it attacks the sapwood of the sprouts.

12.12 : 12.2. EHRLICH, J. **A preliminary study of root diseases in Western White Pine.** *Sta. Pap. Northern Rocky Mt. For. & Range Exp. Sta.* No. 1. 1939. pp. 10. [University of Idaho.]

Western White Pine (*Pinus monticola*) in the Cœur d'Alene National Forest, Idaho, were examined for evidence of root diseases, and the associated fungi were isolated and cultured. Only diseases originating in the bark and outer sapwood were studied. It was found that the most common root disease in mature stands was caused by *Armillaria mellea*, the infection being long-standing in some trees. It appears unlikely, though not impossible, from the available data, that root diseases increase the probability of attack by the Mountain Pine Beetle. Graphs show the relation of degree of infection to radial increment by 5-year periods, and diagrams indicate the relation of density of crown and foliage colour to degree of infection.

12.12 : 12.2. FAWCETT, H. S., and RHOADS, A. S. **Lesions on *Quercus laurifolia* similar to those of leprosis on *Citrus* in Florida.** *Phytopathology* 29, 1939 (907–8).

12.12 : 12.2. FINDLAY, W. P. K. **Note on an abnormal fungus on Birch.** *Trans. Brit. mycol. Soc.* 23, 1939 (169–70). R.A.M. 19 (56).

A fungus collected on a Birch at Aviemore, Inverness, consisted of a coal-black mass about 30 cm. across, resembling a large clinker. There was no sign of any fertile tissue, though basidia were produced in culture. It is considered identical with a species described by Katayevskaya as the 'tchaga' fungus on Birch in the U.S.S.R. and with that described by Campbell and Davidson as a *Poria* belonging probably to the *P. obliqua* complex.

12.12 : 12.2. GOIDÀNICH, G. Il cancro del larice prodotto da *Dasyscypha willkommii*. **[The Larch canker caused by *D. willkommii*.]** *Riv. for. ital.* 1, 1939 (548–53). [It.]

12.12 : 12.2. GOIDÀNICH, G. Note fitopatologiche. I. Malattia dell' *Ulmus pumila* L. causata da una Teleforacea. **[Phytopathological notes. I. A disease of *U. pumila* caused by a member of the Thelephoraceae.]** *Boll. Staz. Pat. veg. Roma* [*n.s.*] 19, 1939 (103–11). [It.] R.A.M. 19 (50).

Branches of a tree with symptoms resembling those due to *Ceratostomella ulmi* showed a dark brown discoloration of the wood, caused by a fungus that may be a species of *Peniophora*.

12.12 : 12.2. GOIDÀNICH, G., and VIVANI, W. Il ritrovamento dell' ascomicete '*Didymosphaeria populina*' Vuill., parassita del Pioppo. **[The finding of the Ascomycete '*D. populina*,' a parasite of Poplar.]** *Boll. Staz. Pat. veg. Roma* [*n.s.*] 19, 1939 (87–102). [It.] R.A.M. 19 (50).

Cultural studies with *Pollaccia radiosa* (*Napicladium tremulae*) from Poplars in Italy establish its genetical connexion with *Didymosphaeria populina*. *D. populina*, both in its ascigerous and imperfect stages, is a true parasite causing conspicuous lesions on the leaves of vigorously growing Poplars. The authors regard the fungus described by Servazzi [*For. Abs.* 1 (141)] as *Venturia populina* as identical with *D. populina*.

12.12 : 12.2. HEMMI, T., and IKEYA, J. **Studies on *Lenzites gibbosa* [Pers.] Hemmi n. comb. causing wood rot of deciduous trees.** *Ann. phytopath. Soc. Japan* 9, 1939 (1–15). [Jap.e.] Biol. Abs. 13 (14042).

12.12 : 12.2. HIRANE, S. **Studies on the parasitism of the rust of *Acacia confusa* Merrill, *Maravalia hyalospora* [Saw.] Diet. II. Effects of the juice of phyllodes on the germination and germ-tube development of urediospores [2].** *Trans. nat. hist. Soc. Formosa* 29, 1939 (13–21). [Jap.e.] L.S.

12.12 : 12.2. HIRT, R. R. **The development of blister rust on young planted Northern White Pine.** *J. For.* 37, 1939 (967–9). [New York State College of Forestry.]

A single exposure of young White Pine trees to telium-bearing bushes of European black currant (*Ribes nigrum*) for 12 or 24 hours under natural conditions resulted in a maximum of 4 per cent. of the trees becoming infected. Continuous exposure to the same species of *Ribes* throughout a summer gave as much as 69 per cent. infection. Within 5 years after infection, approximately one-third of the diseased trees died. *From author's summary.*

12.12 : 12.2. HIRT, R. R. **Canker development by *Cronartium ribicola* on young**

Pinus stobus. *Phytopathology* 29, 1939 (1067–76).

The studies were conducted under natural conditions within the Adirondack region and in central New York. The time necessary for the fungus to become evident in the bark seems to depend to some extent on the distance of the needle spot from the bark tissue. It should be possible by September of each year to estimate the intensity of infection for the preceding year, and by the following spring almost exact information should be available. The average time for branch cankers to extend to the stem was 3 years, thus making it possible to detect and remove infected branches before the stem is invaded. Trees usually died within 2½ to 6½ years after stem infection from a branch canker. *From author's summary.*

12.12 : 12.2. MÜNCH, E. Die Ursachen des 'Korbwuchses' der Junglärchen. **[The causes of 'basket growth' in young Larch.]** *Forstwiss. Cbl.* 61, 1939 (525–31). [G.]

'Basket-growth' results from frost damage to the leading shoot and is associated with the formation of frost rings. Certain Alpine races are particularly predisposed, partly because they are more frost-sensitive when grown outside their original habitat, and partly because damaged leading shoots are replaced very slowly. In Sudeten Larch, and particularly in Japanese Larch, replacement is rapid—hence 'basket-growth' is rare in these two species.

12.12 : 12.2. OLIVEIRA, M. DE L. D'. Inoculações experimentais com o *Bacterium savastanoi* E. F. Smith e o *Bacterium savastanoi* var. *fraxini* N. A. Brown. **[Experimental inoculations with *Bacterium savastanoi* and *B. savastanoi* var. *fraxini*.]** *Agronomia lusitana* 1, 1939 (88–100). [Port.e.]

12.12 : 12.2. SIGGERS, P. V. ***Scirrhia acicola* [Dearn], n. comb., the perfect stage of the fungus causing the brown-spot needle blight of *Pinus*.** *Phytopathology* 29, 1939 (1076–7). [Bureau of Plant Industry, U.S.D.A.]

The imperfect stage of the fungus causing brown-spot leaf blight of *Pinus palustris*, *P. taeda*, and *P. thunbergii* is *Septoria acicola* (Thüm.) Sacc., for which in the author's opinion *Lecanosticta acicola* (Thüm.) Syd. is the correct name. Cultural studies have now proved the connexion between this fungus and its perfect stage, *Oligostroma acicola* Dearn. On the basis of these studies the author furnishes an emended description of the perfect stage and transfers it to the genus *Scirrhia* as *S. acicola* (Dearn) Siggers. It is suggested that the ascospores of this stage are disseminated by wind, unlike the conidia of the imperfect stage, which are adapted for dispersal by rain splash only. The ascospores are suspected to be the source of infections found high above the ground. Some evidence also suggests that the perfect stage appears only after the death of the needle and that the ascospores are produced mainly in the winter and spring.

12.12 : 12.2 : 13.2. ARNAUD, G. La résistance des Ormes à la maladie (*Graphium ulmi*). **[The resistance of Elms to the disease (*Graphium ulmi*).]** *Ann. Epiphyt.* [*n.s.*] 5, 1939 (41–9). [F.] R.A.M. 18 (826).

Of 50 young Elms of the *campestris* group, planted at Versailles in a locality where infection by *Ceratostomella ulmi* was prevalent, only two remained unaffected after ten years. Vigorous trees suffered most. Trees from which the diseased top was removed remained healthy for a time, but became reinfected in equal proportion to trees infected for the first time. There was no evidence of immunization. Objections are offered to the view that the disease is spread by Scolytid beetles. No damage by beetles was observed on young trees, some of which rapidly became infected. On several occasions adult insects were found in a small gallery at the base of healthy branches. A striking disparity was noted between the large numbers of insects emerging from dead and diseased trees and the few trees that became infected each year. Further, no insects are associated with the closely similar disease caused on *Ailanthus glandulosa* by *Verticillium dahliae*.

12.12 : 12.2 : 13.2. DAY, M. W. **Damage to Norway Spruce plantations by the White Pine weevil.** *Quart. Bull. Mich. agric. Exp. Sta.* 22, 1939 (117–18).

The total weevil infestation, past and present, of two small Norway Spruce (*Picea abies*) plantations was found to be 19 per cent. These plantations adjoin a White Pine plantation which has been infested annually but has received control treatment. The insect attacked parts of the Spruce stems 3 to 5 years old and caused a greater loss in height growth in the Spruce than in the White Pine.

12.12 : 12.2 : 13.2. Jusev, V. I. **The insect diseases of Sweet Chestnut.** *Lesnoe Khozyaystvo, Moscow* 1939 (11), (53–7). [R.]

12.12 : 12.2 : 13.2. Soraci, F. A. ***Neodiprion sertifer.*** *J. N.Y. ent. Soc.* 47, 1939 (124). R.A.E. A 28 (17).

Forest plantations and ornamental trees of *Pinus resinosa* and *P. sylvestris* near Gladstone, New Jersey, have recently been severely damaged and in some cases completely defoliated by *Neodiprion sertifer* Geoffr. Eggs of this sawfly were found on the needles of *Pinus ponderosa* on 1st May 1939, and later the larvae were observed feeding on the needles.

12.12 : 12.2 : 13.2. Wolfenbarger, D. O., and Buchanan, W. D. **Notes on Elm twig crotch injuries produced by *Scolytus multistriatus* Marsham.** *J. econ. Ent.* 32, 1939 (377–81). R.A.E. A 27 (644–5).

The injuries are described and illustrated; they were shown to be due to adult feeding. Most of the injuries were found in the upper and outer parts of trees of *Ulmus americana*, *U. procera*, and *U. fulva*. The number of injuries in New Jersey shows a decrease over the period 1933–6; this may be partly due to the destruction of large numbers of Elms suffering from Dutch Elm disease, and possibly also to the reduction in the beetle population owing to climatic factors.

12.12 : 12.2 : 44.3 (73). Roth, E. R., and Sleeth, B. **Butt rot in unburned sprout Oak stands.** *Tech. Bull. U.S. Dep. Agric.* No. 684. 1939. pp. 42. [Division of Forest Pathology, Bureau of Plant Industry.]

This study, based on the dissection and analysis of 3,200 trees of 7 species of Oak, gave no evidence that sprouts develop independent root systems. The sprouting capacity of Oak stumps decreases with increase in size and age. It was found that sprout stands following severe burns had a lower decay incidence than those resulting from cutting operations without fire. Heart-rotting fungi entered from the parent stump in 86 per cent. of the cases, and sprouts from large stumps are more subject to butt rot than those from small stumps, while the chances of infection increase with the height at which the sprouts come off the old stump. Infection from parent stump will seldom occur before 10 years, as the heartwood connexion between stump and sprout is seldom formed earlier. Chestnut Oak had the lowest percentage of decayed stumps, 11 per cent., White Oak 19 per cent., Red Oak 22 per cent., Scarlet Oak 28 per cent., and Black Oak 39 per cent. Sixty-two per cent. of the decayed sprouts, from which butt-rotting fungi were isolated, yielded *Stereum gausapatum*; *Fistulina hepatica* and *Armillaria mellea* were the next most frequently isolated. The average annual rate of penetration by *S. gausapatum* was 2–3 in. and the average height of decay by this species was 55 in. Methods of control are suggested. *From author's summary.*

12.12 : 21.1–2 : 11.14 : 12.2. Timofeev, V. P. **The dying off of Spruce through moisture deficiency.** *Lesnoe Khozyaystvo, Moscow* 1939 (9), (6–15). [R.]

The drought in the second part of 1938, combined with hot weather from July to September, caused die-back of Spruce in many parts of Russia. In two stands near Moscow, of 60–70-year-old pure Spruce of 0·9 density, and growing on somewhat podsolized clayey soils with deep turf, dying off was correlated with a moisture content in the 'A' and 'B' horizons equivalent to twice their hygroscopic moisture or less from August to October.

12.12 : 42.5. Whitby, G. S. **The effects of sulphur dioxide on vegetation.** *Chem. Ind.* 58, 1939 (991–9). [Chemical Research Laboratory, Teddington.] L.S.

A review of the chief results of the comprehensive 8-year investigation at Trail, British Columbia, on the effects of SO_2 in smelter fumes upon vegetation.

It was found that where SO_2 retarded tree growth it also inhibited or greatly reduced the trees' capacity for responding to favourable precipitation, whereas in control trees precipitation and the trend of growth were often closely correlated. Before special plant was installed to utilize the SO_2 output of the smelter, retardation of tree growth was traceable to about 21 miles down river; a group of Douglas Fir near this point is estimated to have lost 0·75 in. of diameter increment over the period 1922–36. When the SO_2 concentration was reduced, the growth curves of the trees slowly returned to normal.

The effects of fumigation were also studied in a series of controlled experiments, during which the experimental plots were enclosed in celluloid cabinets. These experiments showed

that conifers are much more susceptible during active growth than during the period of dormancy. Douglas Fir treated with SO_2 at the high concentration of 20 parts per million for 14 hours showed no sign of injury in February. Douglas Fir and Yellow Pine fumigated in February for 69 hours at a concentration of 2·0 p.p.m. remained uninjured; in the latter half of March, however, the same concentration applied for 35 hours, in the daylight only, destroyed 75 per cent. of the foliage. Transplants were more susceptible than young trees grown *in situ*, and seedlings more susceptible than older trees. A concentration of 1·08 p.p.m. applied for 8 hours slightly injured 1-year-old seedlings, but did no damage to those in their second year: a similar concentration (1·11 p.p.m.) applied for 15 hours killed 50 per cent. of the former and 21 per cent. of the latter. Larch was the most susceptible of the conifers tested, sustaining injury after 8 hours' fumigation at 0·3 p.p.m. at the most susceptible time of the year, with an average relative humidity of 67 per cent.

In the field, the sulphur content of leaves was observed to decrease with increasing distance from the smelter. It was found, also, that the sulphur content of leaves was cumulative, so that a higher sulphur content in the vegetation could be traced to a far greater distance from the smelter than could recognizable injury to the plants. Conifer needles, owing to their long life, increased noticeably in sulphur content from year to year. The fumigation experiments showed that, broadly speaking, the sulphur content may rise to four times the normal without causing injury. An important factor in injury was the rate at which SO_2 was administered: small doses applied over a long period were assimilated and oxidized without injury to the plant, but heavy doses over a short period sometimes caused damage even when the sulphur content was raised to a small extent only.

Fumigation of conifer seeds and pollen at the concentrations occurring near the smelter had no effect on germination, though a concentration of 66 p.p.m. over 10 days destroyed the viability of the pollen.

Experiments with field crops indicated that any factor that favours opening of the stomata and active photosynthesis also favours SO_2 absorption and increases injury: thus light intensity, relative humidity, and soil moisture all contributed to a higher rate of damage.

12.14. Morphology. Anatomy. Histology

12.14 : 12.19 (69). VAUGHAN, R. E., and WIEHE, P. O. **Studies on the vegetation of Mauritius: II. The effect of environment on certain features of leaf structure.** *J. Ecol.* 27, 1939 (263–81).

The variation in certain features of leaf morphology under dry and humid conditions has been investigated for 9 indigenous species. It is shown that dry conditions induce considerable changes in leaf form, and that these modifications are related to heterophylly, the xeromorphic significance of which is discussed. Stomatal frequency is specific in character and a considerable increase is found under dry conditions, accompanied by a small decrease in area. The increase in frequency is partly due to an increase in the stomate mother cells. The percentage area of leaf covered by stomata is found to be greater in the lowlands. Lower epidermal cells show a small increase in frequency in the lowlands and the decrease in area is also small and comparable with that of the stomata. The problem of variability in the individual and between individuals of the same species is discussed. *From authors' summary.*

12.14. ANDREWS, S. R., and GILL, L. S. **Determining the time branches on living trees have been dead.** *J. For.* 37, 1939 (930–5). [Bureau of Plant Industry, U.S.D.A.]

Relatively accurate determination of the time branches have been dead should be based on the number of rings of callus which have developed since death. This method has a further advantage that it may be used when branches are decayed or badly weathered. Attempts to correlate age of living branch with age of bole showed considerable discrepancy which was greatest for the lower branches of the crown. It appears that only 2 per cent. of the determinations of time since death would be correct if based on the subtraction of age of dead branch from age of bole.

12.14 : 12.2. METCALFE, G. **Observations on the anatomy of the Cricket-bat Willow [*Salix caerulea* Sm.].** *New Phytol.* 38, 1939 (150–8). Biol. Abs. 13 (17559).

12.14 : 31.2 : 12.2. BRANSFORD, L., and MUNGER, T. T. **Formation of knots in Douglas Fir.** *For. Res. Notes Pacific Northwest For. Exp. Sta.* No. 27, 1939 (6).

A dissection study of 4 trees from a 100-year-old stand showed that knot diameter increases with height above ground, while length of black knot decreases with increasing height, and that, in the lower part of the bole, a period of 54 years elapsed from the time a limb died until occlusion of the knot was complete.

12.14 : 65. POTTS, S. F. **A method for determining the quantity of foliage per acre of woodland.** *J. For.* 37, 1939 (922–3).

Following the thorough spraying of a stand with lead arsenate, an analysis was made of sample sheets of blotting-paper that had been scattered over the ground during the spraying, and of leaves from different parts of the canopy, to determine the amount of lead arsenate deposited per unit area of ground surface and average leaf surface. The amount on the ground in pounds per acre subtracted from the total amount used per acre gave the lead arsenate on the foliage. Dividing the amount of lead arsenate per square inch of leaf area into the total amount on the foliage gave a figure for the total area of foliage per acre. It was found that the Oak types in New England support an average stocking of 3 to 6 acres of foliage per acre and that 60 to 84 per cent. of the spray was caught by the foliage.

12.15. Mode of Life. Adaptability. Habit. Phenology

12.15 : 21.6 : 56 : 12.2 (43.1–5). MEYER, J. Über die Kronenabwölbung und Zuwachsschwankungen der Kiefer in Nordostdeutschland. [**Rounding-off of the crown and variations in the increment of Scots Pine in North-east Germany.**] *Z. Forst- u. Jagdw.* 71, 1939 (369–403, 431–52). [G.g.] [Versuchsanstalt für Waldwirtschaft, Eberswalde.]

Crown analyses on different sites revealed a distinct connexion between the rounding-off of the crown and long-period variations in the height (and diameter) increment of the tree. The length increment of newly formed branches is at first equal, on the average, to 60–70 per cent. of the increment of the main axis. If the latter increment is great, that of the branches rapidly diminishes after some years and the form of the crown becomes pointed and regular. If, however, the increment of the main axis is small over a fairly long period, that of the branches becomes and remains great in proportion, and the crown rounds off. Only when such a period of slow growth is followed by one of considerable recovery, does the main shoot, or a side branch replacing it, form a new pointed crown above the round one, which is then gradually suppressed. Periods of slow growth in the regions examined were correlated with prolonged drought periods and often also with damage from insects, fungi, &c. The more acute the atmospheric drought periods and the drier the soil, the more pronounced is the rounding-off of the crown and the lower the tree height at which it occurs.

12.15 : 12.11 : 12.2. RIGHTER, F. I. **Early flower production among the Pines.** *J. For.* 37, 1939 (935–8). [Institute of Forest Genetics, California Forest and Range Exp. Sta.]

Species of Pine may attain reproductive maturity at a relatively early age. Ovulate flowers were produced by 55 species and varieties at an average of minimum ages of 5·2 years, and pollen was produced by 39 species and varieties at an average of minimum ages of 4·4+ years. One *Pinus densiflora* tree bore functional ovulate flowers at 3 years, and pollen from 2-year-old trees of *P. densiflora*, *P. ponderosa*, and *P. thunbergii* has germinated. A hybrid of *P. attenuata* × *P. radiata* produced fertile seed at 6 years. At Placerville, California, where these data were obtained, the climate is mild with a minimum temperature of 14° F. and a growing season of 237 days. Seedlings are given plenty of room to develop, being 6 in. apart in the seedbed, and they are adequately watered during the dry season. The early-flowering species are listed.

12.15 : 12.2. **Jack Pine seed habits.** *Tech. Note Lake States For. Exp. Sta.* No. 148. 1939. p. 1.

A seed tree of *Pinus banksiana* was burned and the seed fall measured at various distances. For the first 40 days after burning the seed fall was moderately heavy, but during the ensuing period up to the 70th day it decreased rapidly. The rate of seed fall immediately beneath the tree was 68,000 per acre, but at a distance of 1 chain only 1,000 seeds fell per acre. No significant quantity of seed fell at more than 1 chain. The wind velocity during the experiment did not exceed 13 miles per hour.

12.15 : 12.2. **When do Jack Pine seeds germinate?** *Tech. Note Lake States For. Exp. Sta.* No. 149. 1939. p. 1.

Seeds of *Pinus banksiana* were found to germinate when moisture was adequate and the maximum air temperature exceeded 64° F.

12.15 : 23.1 : 12.2. **Black Spruce maintains a year-round seed supply.** *Tech. Note Lake States For. Exp. Sta.* No. 146. 1939. p. 1.

Picea mariana retains its cones for several years and a large number of seeds remain in the cone for a year or more. Viability decreases with age, but a considerable portion of the seed remains viable. Seeds are shed throughout the year, but a good supply should exist at whatever season the trees are cut.

12.15 : 23.1 : 12.2. **Black Spruce is a limited air traveller.** *Tech. Note Lake States For. Exp. Sta.* No. 147. 1939. p. 1.

Very little seed of *Picea mariana* travels for more than 100 ft. from the edge of a stand; beyond this distance the supply of seed is inadequate for natural reproduction.

12.19. Geographical Distribution. Plant Geography and Sociology

12.19 : 11.46 : 11.6(213). WALTER, H. Pflanzensoziologie und Sukzessionslehre. **[Plant sociology and the study of plant succession.]** *Z. Bot.* 31, 1937 (545–59). [G.] S. and F. 2, 1939 (169).

In tropical rain forests where the soil is poor there is little loss of nutrients because practically the whole stock is locked up in growing vegetation. Should the vegetation be burnt, it is easy for the nutrients to be lost through erosion, and degradation sets in. In tropical regions degradation is the result of some such process, whereas in temperate regions it is more likely to be the result of removal of material by human agency.

12.19 (54). CHAMPION, H. G. **The relative stability of Indian vegetational types.** *Indian For.* 65, 1939 (511–23). Extract from *J. Ind. Bot. Soc.* 18, 1939 (1–12).

12.19 : 09.7 (79.4). JENSEN, H. A. **Vegetation types and forest conditions of the Santa Cruz Mountains unit of California.** *For. Surv. Release California For. & Range Exp. Sta.* No. 1. 1939. pp. 55.

12.19.1. *Regional Floras*

12.19.1 (498). CRETZOIU, P. Distribuţia geografică generală a plantelor lemnoase din România. **[Geographical distribution of woody plants in Rumania.]** *Rev. Pădurilor* 51, 1939 (897–903). [Rum.f.]

Distribution of *Fagus orientalis* Lipsky, *Acer tataricum* L., *A. pseudoplatanus* L., and *A. laetum* C. A. Mey. The general range of the genus *Acer* is also outlined.

12.19.1 (71.3–6 : 74). HEIMBURGER, C. C. **Notes on Red Spruce.** *For. Chron.* 15, 1939 (226–7).

The St. Lawrence Valley separates the range of Red Spruce in Canada into a small northern part and a larger southern part, which merges with the New England range of this species. At no point in the northern part does Red Spruce enter the boreal forest, although it is found in this and the subalpine zones in the New England States. A number of transition forms between Red and Black Spruce have been noted growing on the same site.

12.19.1 : 12.2 (88.1). SANDWITH, N. Y., *et al.* **Contributions to the flora of Tropical America : XLIII. Further results of recent collections in British Guiana.** *Kew Bull.* No. 10, 1939 (545–63).

12.19.1 : 12.2 (91). AIRY-SHAW, H. K. **Additions to the flora of Borneo and other Malay Islands. XVI. The Myristicaceae of the Oxford University Expedition to Sarawak, 1932.** *Kew Bull.* No. 10, 1939 (539–45).

12.19.1 : 12.2 (91). AIRY-SHAW, H. K. **Additions to the flora of Borneo and other Malay Islands : XV. The Winteraceae, Lauraceae, and Menispermaceae of the Oxford University Expedition to Sarawak, 1932.** *Kew Bull.* No. 10, 1939 (533–8).

12.19.1 : 12.2 (91). RIDLEY, H. N. **Notes on some Malayan Rubiaceae.** *Kew Bull.* No. 10, 1939 (593–613).

12.19.2. *Forest Types and Woodland Communities past and present*

12.19.2 (76.3). HALL, T. F., and PENFOUND, W. T. **A phytosociological study of a Cypress-Gum swamp in south-eastern Louisiana.** *Amer. Midl. Nat.* 21, 1939 (378–95). Biol. Abs. 13 [12588].

12.19.2 (77.2). MCCOY, S. **A phytosociological study of the woody plants constituting twenty-five type forests of the**

Illinoian till plain in Indiana. *Proc. Ind. Acad. Sci.* 48, 1939 (50–66). Soil Cons. Lit. 3, 6 (187).

12.19.2 : 12.12 (79.8). BAXTER, D. V., and WADSWORTH, F. H. **Forest and fungus succession in the lower Yukon valley.** *Bull. Univ. Mich. Sch. For. Cons.* 9, 1939. pp. 52. [University of Michigan, Ann Arbor.]

Upland, muskeg, and alluvial flat form the three general forest areas in the lower Yukon meander belt. The forests of the alluvial flat are the only ones of commercial importance, and in these Spruce grows to 36 in. diameter and Birch to 24 in. In the pioneer stages of succession on the alluvial flats, Willows are dominant for about 45 to 50 years. Then fungal cankers, heart rot, windfall, ice injury, and competition for light eliminate a large proportion of this species. Spruce, with some Birch, eventually composes the dominant forest, and this succession, from bar formation to the climax forest, takes approximately 175 years. *Melampsora bigelowii* was found to be the fungus causing most damage to Willow seedlings up to 2 years old. *Pholiota adiposa*, *Favolus canadensis*, *Trametes suaveolens*, and *Fomes igniarius nigricans* were the chief causes of rot in the overmature Willow forest. In the climax forest, *Fomes pini* is common on Spruce and *F. igniarius nigricans* is prevalent on Birch in the forest about 175 years after its establishment, and Birch becomes badly diseased before the stable climax develops. Certain rusts and their alternate hosts, which are not found in other communities, appear in the climax forest. Frozen soil and ice damage may lead to changes in stand composition. *Abies*, *Tsuga*, and *Pinus* are not present in this forest, which may account for the fact that the tree-rust flora differs from that of the south coast of Alaska. Neither *Polyporus schweinitzii* nor *P. sulphureus* were found. *From authors' summary.*

12.2. *Special [Systematic] Botany*

12.2. BADCOCK, E. C. **Preliminary account of the odour of wood-destroying fungi in culture.** *Trans. Brit. mycol. Soc.* 23, 1939 (188–98). R.A.M. 19 (54).

The characteristic odour of cultures of wood-destroying fungi is considered a valuable aid to identification. A table is presented showing the odour of cultures of 80 different species and, where available, the smell of the natural fruit bodies as recorded by various authors. The odour of several strains of the same species was identical, even when they had been isolated from different hosts, and many species whose natural fruit bodies had no perceptible odour produced a distinct aroma in culture.

12.2. BUCHHOLZ, J. T. **The generic segregation of the *Sequoias*.** *Amer. J. Bot.* 26, 1939 (535–8). [University of Illinois.] O.B.D.

Previous researches by the author [*For. Abs.* 1 (143)] have shown that the two species included in the genus *Sequoia* are generically distinct. A new genus is therefore set up for *Sequoia gigantea*, which now becomes *Sequoiadendron giganteum* (Lindl.) Buchholz, while *Sequoia sempervirens* remains unchanged. A formal generic description in Latin is given and the numerous differences between the two trees are presented in tabular form.

12.2. GHESQUIÈRE, J. Deux Legumineuses du genre *Baikiaea* Benth. **[Two Leguminosae of the genus *Baikiaea*.]** *Rev. Zool. Bot. afr.* 32, 1939 (246–51). [F.]

B. robynsii Ghesq. n.sp., *B. suzannae* Ghesq. n.sp., and *B. suzannae* var. *ripicola* Ghesq., n.var., are described with notes on distribution.

12.2. HAFEEZ-UD-DIN, KHAN SAHIB. **A note on *Ferula foetida* [syn. *F. asafoetida*: commercial name Hing.]** *Indian For.* 65, 1939 (546–50).

12.2. STECKI, K. Nowa forma sosny pospolitej. **[A new form of *Pinus sylvestris*.]** *Roczn. Nauk rol.* 41, 1937 (217–19). [Pol.g.]

P. sylvestris L. lusus *sigillata pilsudskiana*, n.p.

12.2 : 01. DAVIDSON, R. W., CAMPBELL, W. A., and BLAISDELL, D. J. **Differentiation of wood-decaying fungi by their reactions on gallic or tannic acid medium.** *J. agric. Res.* 57, 1938 (683–95).

This work was based on a previous study from which it was determined that wood-decaying fungi of the white-rot group, when grown on media containing small amounts of tannic or gallic acid, form a dark diffusion zone under the fungus mats, whereas fungi of the brown-rot group give no such reaction. 210 fungi were tested in this way and 80 per cent. of the fungi associated with brown carbonizing rots gave no reaction, while 96 per cent. of the fungi associated with white rots gave positive reactions, though the intensity and

time of reaction varied considerably. Growth behaviour on the media used showed variations of value in cultural identification of fungi.

12.2 : 01. MELVILLE, R. **Ambiguous Elm names. II. *Ulmus minor* Mill.** *J. Bot., Lond.* 77, 1939 (266–70). O.B.D.

It is proposed that the name *Ulmus minor* Mill. should be rejected as a *nomen confusum*.

12.2 : 01. MOURASHKINSKY, K. E. **Iodine staining as a means of differentiation of timber fungi.** *Bull. Soc. Nat. Moscou* (Sect. biol.), (*n.s.*) 47, 1938 (261–5). [R.f.] R.A.M. 18 (645).

Colour reactions as an aid to identification.

12.2 : 01. SVENSON, H. K. ***Quercus rubra* once more.** *Rhodora* 41, 1939 (521–4).

In the writer's opinion *Quercus rubra* L. is the valid name for the Northern Red Oak, while *Q. falcata* Michx. should stand for the southern species.

12.2 : 2 : 3 : 6. MATTOON, W. R. **Slash Pine.** *Fmrs' Bull., U.S. Dep. Agric.* No. 1256, 1922. *Rev. ed.* 1939. pp. 56.

Slash Pine (*Pinus caribaea*) is a dual-crop tree, being used for both wood and turpentine production. This bulletin gives detailed information on the growth, management, exploitation, and utilization of this species in the United States.

12.2 : 23.26 (47.6). LASHKEVICH, K. A. **Oak cultivation in the steppe.** *Lesnoe Khozyaystvo, Moscow* 1939 (9), (45–8). [R.]

Favourable results were obtained on chernozem soils near Mariupol, Ukraine, by planting 3-year seedlings of late varieties.

12.2 (52). HOTTA, T. **Contributions to the knowledge of the systematics of *Morus* in Japan, XV–XVI.** *Bot. Mag., Tokyo* 53, 1939 (292–6, 335–8).

12.2 (54.1). RAIZADA, M. B. **Recently introduced or otherwise imperfectly known plants from the upper Gangetic Plain.** *Indian For. Rec.* [*n.s.*] *Botany* 1, 1939 (223–36). Manager of Publications, Delhi.

12.2 : 56. VASHKULAT, P. N. ***Salix pyramidalis* Bud.** *Lesnoe Khozyaystvo, Moscow* 1939 (9), (26–30). [R.]

Data on diameter and height growth.

12.2 : 31 (63). GIORDANO, G. Cenni monografici sulle piante forestali e sui legnami dell' A.O.I. [**Monographic notes on the trees of Italian East Africa and on their woods.**] *Riv. for. ital.* 1, 1939 (554–60, 597–606).

Notes on *Syzygium guineense* DC., *Schefflera abyssinica* (Hochst.) Harms, *Polyscias ferruginea* (Hiern) Harms, *Mimusops kummel* Bruce, *Sideroxylon oxyacantha* Baill., *Acokanthera abyssinica* K. Sch., *Nuxia congesta* R. Br., *Cordia abyssinica* R. Br., *Stereospermum kunthianum* Cham., and *Galiniera coffeoides* Del.

12.2 (63 : 67.7). ALVINO, G. Il bambù alpino nell' Impero. [**The Alpine Bamboo in the Italian Empire.**] *Riv. for. ital.* 1, 1939 (487–94). [It.]

Distribution, ecology, silviculture, and utilization of *Arundinaria alpina* in the Italian African possessions.

12.2 (67.5). STANER, P. Revision des Rhamnacées du Congo Belge. [**Revision of the Rhamnaceae of the Belgian Congo.**] *Bull. Jard. bot. Brux.* 15, 1939 (393–424). [F.]

12.2 (73). KRUKOFF, B. A. **The American species of Erythrina.** *Brittonia* 3, 1939 (205–337).

12.2 : 21.6 : (74.7). COOK, D. B. **European Larch reproduces in Eastern New York.** *J. For.* 37, 1939 (891–3).

A group of 74-year-old European Larch planted at Stephentown, N.Y., has produced an abundance of reproduction. The maximum age of the reproduction is 46 years, with a height of 70 ft. and a d.b.h. of 17·6 in. The progeny have been able to compete successfully with grass, shrubs, and native pioneer tree species. The American generations have maintained good form and rapid growth, and some of them are producing cones and fertile seed. *From author's summary.*

12.2 (78). LITTLE, E. L. **Mexican Pinon [*Pinus cembroides* Zucc.].** *Res. Note Southwestern For. & Range Exp. Sta.* No. 47. 1938. pp. 3.

This Pine has a limited occurrence in the south-western United States. Its specific characters are compared with those of *Pinus edulis*; both of these Pines are considered sufficiently distinct to be regarded as separate species.

12.2 (77). DARLINGTON, H. T., & CULVER, L. B. **Keys to the species of *Ribes* occurring in the Great Lakes Region.** *Circ. Bull.*

Mich. St. Coll. agric. Exp. Sta. No. 170, 1939. pp. 24.

12.2 (79.4). COLLINGWOOD, G. H. **California White Oak: *Quercus lobata* Née.** *Amer. Forests* 45, 1939 (558–9).

12.2 (81). DUCKE, A. **Notes on some highly aromatic Lauraceae of Brazilian Amazonia.** *Trop. Woods* 60, 1939 (1–10).

12.2 (91). SYMINGTON, C. F. **Notes on Malayan Dipterocarpaceae. V.** *Straits Sett. Gdns. Bull.* 10, 1939 (336–86).

12.2 : 12.19.1 (91.1). AIRY-SHAW, H. K. **Additions to the flora of Borneo and other Malay Islands. XIII: The Theaceae and Symplocaceae of the Oxford University Expedition to Sarawak, 1932. XIV: The Ilicaceae and Myrsinaceae of the Oxford University Expedition to Sarawak, 1932.** *Kew Bull.* 9, 1939 (504–17).

12.2 : 2 : 3 (91.4). BAHA, H. A. **The national tree of the Philippines.** *Philipp. J. For.* 2, 1939 (253–7). [Bureau of Forestry, Philippines.]

Botanical description, range and habitat, uses, and management of *Pterocarpus vidalianus* Rolfe and related species, known locally as Narra.

12.2 : 12.19.1 (96.1–8). KANEHIRA, R., and SUMIHIKO, H. **New or noteworthy trees from Micronesia. XXI.** *Bot. Mag., Tokyo* 53, 1939 (151–7). L.S.

Latin diagnoses and brief notes in English on *Cleidion sessile*, *Bridelia palauensis*, *Rinorea palaucica*, *Barringtonia longipedicellata*, *Terminalia crassipes*, and *Cordia micronesica*, spp. nov.

12.2 : 12.19.1 (96.1–8). KANEHIRA, R., and SUMIHIKO, H. **New or noteworthy trees from Micronesia. XXII.** *Bot. Mag., Tokyo* 53, 1939 (189–93). L.S.

Short notes on a number of species, none of them new.

13. FOREST ZOOLOGY

13.1. *General Zoology*

13.1 : 23.3 (410). LACK, D. **Further changes in the Breckland avifauna caused by afforestation.** *J. Anim. Ecol.* 8, 1939 (277–85).

Comparisons are made between the successive breeding and midwinter bird populations of Breckland heaths and Pine plantations from 4 to 15 years old. Both in summer and in winter, the changes in the populations resulting from the increasing tree heights are striking. Chaffinch and coal tit colonize the British plantations much earlier than they do the German ones. The factors limiting distribution are discussed. *From author's summary.*

13.1 : 13.2 (43.1–5). FRANK, A. Der Maikäferflug 1939 im Bienwald. [**The flight of cockchafers in the Bienwald during 1939.**] *Forstwiss. Cbl.* 61, 1939 (581–98). [G.g.]

13.1–2 (54 : 59.1 : 59.3–9 : 91 : 54.87 : 922). BEESON, C. F. C. **New species and biology of *Coccotrypes* and *Thamnurgides* [Scolytidae, Col.].** *Indian For. Rec.* [*n.s.*] *Entomology* 5, 1939 (279–308). Manager of Publications, Delhi.

In the fruit and bark boring genera *Coccotrypes* and *Thamnurgides* 5 and 17 new species respectively are described from India, Burma, Indo-China, Federated Malay States, Ceylon, and Java. The food-plants and distribution of species occurring in India, Burma, and Ceylon are given with notes on biology. *Author's summary.*

13.1 : 12.19 (7). DERSAL, W. R. VAN. **Some important timber trees and wildlife.** *Soil Conserv.* 5, 1939 (103–7).

The use of some common North American timber trees as sources of food for native animals.

13.1 : 12.12. CUMPSON, D. M. **Observations on the bionomics and morphology of seven species of the tribe Paropsini (Chrysomelidae).** *Proc. Linn. Soc. N.S.W.* 64, 1939 (353–66). P.R.

13.1 : 12.12. KASTON, B. J. **The native Elm bark beetle, *Hylurgopinus rufipes* Eichhoff, in Connecticut.** *Bull. Conn. agric. Exp. Sta.* 420. 1939. pp. 39.

Hylurgopinus rufipes occurs over most of the eastern and middle-western United States and in Connecticut there are usually one and a half generations per annum. Over-wintering larvae give rise to beetles whose progeny hibernate during the following winter and over-wintering adults give rise to beetles whose progeny hibernate the next winter as larvae. Eggs do not survive the winter and only a very few individuals hibernate in the pupal stage. For breed-

ing the beetles prefer shaded limbs over 2 in. in diameter. The average number of eggs per female is about 60 and only about 15 young beetles emerge per family. Eggs hatch in 6–12 days. The larval stage varies from a minimum of 29 days, at 24·5° C., to about 40 or 50 days in the field during the summer. The larval galleries tend to run with the grain and the rate of tunnelling is variable. Emerging young beetles fly to healthy Elms to feed in bark tunnels before breeding. A flight range of at least a mile has been noted. The bark tunnels are analogous to those of *Scolytus multistriatus* and hence important in relation to the spread of Dutch Elm disease. Low winter temperatures have little effect on the hibernating larvae, but only about half of the adults survive. Dryness and competition with other larvae may account for the high mortality during the growing season. Predators and parasites appear to have little significance. *From author's summary.*

13.1 : 12.12. NOBLE, N. S. **A new species of *Megastigmus* parasitic on *Tepperella trilineata* Cam., a wasp causing galling of the flower buds of *Acacia decurrens*.** *Proc. Linn. Soc. N.S.W.* 64, 1939 (266–78). P.R.

13.1 : 12.12. NOBLE, N. S. **A new species of Chalcid (genus *Eurytoma*) associated with *Tepperella trilineata* Cam., a wasp causing galling of the flower buds of *Acacia decurrens*.** *Proc. Linn. Soc. N.S.W.* 64, 1939 (223–41). P.R.

13.1 : 13.2 : 12.2. CANN, F. R. **A further instance of the occurrence of a stony deposit in insect tunnels in a sample of Teak [*Tectona grandis* Linné f.]** *Emp. For. J.* 18, 1939 (268).

A stony deposit entirely similar to that previously described from tunnels of *Xyleutes ceramica* [*For. Abs.* 1 (152)] was found in pinholes typical of Scolytid and Platypodid boring beetles in a sample of Siamese Teak.

13.1 : 13.2. DOWDEN, P. B. ***Schizonotus sieboldi*, an important parasite of the imported willow leaf beetle [*Plagiodera versicolora*].** *J. agric. Res.* 58, 1939 (581–92). Repr. [Bureau of Entomology and Plant Quarantine, U.S.D.A.]

13.1 : 13.2. SWAIN, R. B. **Notes on the biology of the Great Basin tent caterpillar, *Malacosoma fragilis* Stretch [Lep., Lasiocampidae].** *Canad. Ent.* 71, 1939 (76–7). R.A.E. A 27 (528).

Notes on the bionomics of *Malacosoma fragilis* in Colorado, where it is often a serious pest of *Populus tremuloides*. The species is the most abundant of its genus in the Rocky Mountain region of the United States and feeds upon a wide variety of trees and shrubs. Mention is made of parasites.

13.1 : 13.2. WATANABE, C. ***Meteorus japonicus* Ashmead, a parasite of the gypsy moth, *Lymantria dispar* Linné.** *Insecta matsum.* 13, 1939 (63–5). R.A.E. A 27 (614–15).

The male of *Meteorus japonicus* is unknown; the female of the species is parasitic on larvae of *Lymantria dispar*. *M. nipponensis* Vier. is considered synonymous with *M. japonicus*; but *M. pulchricornis* Wesm., which parasitizes the same moth in Europe, is distinct.

13.1 : 13.2. WATANABE, C. **A new species of genus *Aphidius* Nees and redescription of *Aphidius japonicus* Ashmead (Taxonomic Notes on Aphidiidae of Japan. I).** *Insecta matsum.* 13, 1939 (81–4). R.A.E. A 27 (615).

The species is parasitic on *Lachnus* [*Tuberolachnus*] *salignae* Gmel. on Willow in Hokkaido.

13.1 : 13.2. WOLFF, M. Einige Bemerkungen über die Douglasfichten-Afterblattlaus [*Gilletteella cooleyi* Gill.] **[Notes on *Gilletteella* [*Chermes*] *cooleyi* Gill.]** *Z. Forst- u. Jagdw.* 71, 1939 (485-96). [G.]

13.2. *Special* [*Systematic*] *Zoology*

13.2(410). EMDEN, F. VAN. **Larvae of British beetles. I. A key to the genera and most of the species of British Cerambycid larvae.** *Ent. mon. Mag.* 75, 1939 (257–64, 265–73): 76, 1940 (7–13).

13.2 (54). GARDNER, J. C. M. **New Indian Cerambycidae.** *Indian For. Rec.* [*n.s.*] *Entomology* 6, 1939 (1–14). [Forest Research Institute, Dehra Dun.]

The following new species are described: *Noserius indicus* ex *Xylia dolabriformis*, Bombay; *Diorthus sericeus* ex *Pterocarpus marsupium* and *Acacia* sp., Madras; *Trirachys atkinsoni* ex *Pentacme suavis*, Burma; *Merionoeda phoebe* ex *Phoebe lanceolata*, United Provinces; *Kunbir salemensis*, Madras; *Clytus minutus* ex *Tectona grandis*, Madras; *Clytus ceylonicus* ex *Vitex altissima*, Ceylon; *Xylotrechus subcarinatus* ex

Phoebe lanceolata, United Provinces; *Agalophis longispinis* ex *Beilschmiedia sikkimensis*, Darjeeling; *Epipedocera chakhata*, United Provinces; *Epipedocera acaciae* ex *Acacia arabica*, Bombay; *Dere posticata*, Madras; *Dere acaciae* ex *Acacia catechu*, Central Provinces; *Dere cassiae* ex *Cassia fistula*, Burma; *Artimpaza dehra* ex *Phoebe lanceolata*, United Provinces. The male of *Thranius biplagiatus* Gahan is described. *Author's summary.*

13.2 (73). GRANOVSKY, A. A. **Three new species of Aphiidae [Homoptera].** *Proc. ent. Soc. Wash.* 41, 1939 (143–54). L.S.

The species are *Drepanosiphum oregonensis* on *Acer macrophyllum*, *Calaphis coloradensis* on *Betula* spp., and *Myzocallis meridionalis* on *Quercus* spp.

13.2 (77.6). DODGE, H. R. **The bark beetles of Minnesota [Coleoptera: Scolytidae].** *Tech. Bull. Univ. Minnesota agric. Exp. Sta.* No. 132. 1938. pp. 60.

A systematic account of the Scolytids occurring or likely to occur in Minnesota, with keys to genera and species, and a field key based on the nature of the galleries and host trees. The economic importance of the beetles, their bionomics, and natural or artificial control are briefly discussed.

13.2 : 07 (94). RATCLIFFE, F. N., and CUMMINS, J. E. **Termite [white ant] research in Australia.** *Emp. For. J.* 18, 1939 (221–8).

In Eastern Australia there are four species of termites that are chiefly responsible for damage to growing trees—*Coptotermes acinaciformis*, *C. frenchi*, *Calotermes insularis*, and *Porotermes adamsoni*. It has been found that the termites always gain access to the tree through exposed dead wood. It is not always possible to correlate degree of resistance to attack shown by seasoned timber with infestation of living trees of the same species.

Among the species causing most damage to timber in service are *C. acinaciformis*, *Rhinotermes intermedius*, *Mastotermes darwiniensis*, and *Eutermes exitiosus*. Control measures include (1) Constructional methods. The use of metal termite stops of the continuous strip type has been advocated. (2) The use of chemical wood preservatives. Recent developments in field and laboratory methods for testing against termites are described. The charring of the true wood of seasoned poles before treating with preservative is advocated as a means of increasing absorption of preservative and of reducing subsequent checking. The soil adjacent to the pole and to a depth of 12–18 in. is puddled with creosote as well. (3) The use of timbers possessing a natural resistance to termite attack. The fact that wood-destroying termites belong to three different families with different food preferences makes it difficult to find tree species entirely resistant. There is also a variability in individual species of timber. Some species of Cypress Pines (*Callitris*) are highly resistant to termite attack. (4) Direct control by poisons. Arsenicals are the most effective of the substances so far tested. A small quantity of finely powdered white arsenic blown into the nursery will destroy a mound colony in a few weeks.

13.2. BENSON, R. B. **On the genera of the Diprionidae [Hymenoptera Symphyta]—with a key to world genera.** *Bull. ent. Res.* 30, 1939 (339–42).

2. SILVICULTURE

21. SILVICULTURAL CHARACTERS OF TREE SPECIES

21.1 : 12.11 : 01. **Bibliography on cold resistance in plants.** Imperial Bureau of Plant Breeding and Genetics, School of Agriculture, Cambridge. 1939. pp. 22.

21.3 : 12.11 : 11.46–7. MITCHELL, H. L., and CHANDLER, R. F. **The nitrogen nutrition and growth of certain deciduous trees of Northeastern United States, with a discussion of the principles and practice of leaf analysis as applied to forest trees.** *Black Rock For. Bull.* No. 11. 1939. pp. 94.

Series of from 3 to 6 quarter-acre plots were established in mixed hardwood stands on each of 6 different sites. One plot of each series served as a control, and the others were supplied with varying amounts of nitrogenous fertilizer. Near the end of the same growing season, leaf samples, for chemical analysis, were taken from dominant and codominant trees on each plot. The average radial increment of trees was determined by means of increment borings. Both the growth and the foliage nitrogen

content of the trees increased with nitrogen supplements through a range of nitrogen supplies equivalent in effect to those of poor to good natural soils. Further additions of nitrogen resulted in successively smaller increases in radial increment and internal (leaf) nitrogen concentration. On the fertilized plots the leaves of all species were from 30 to 150 per cent. greater in size and much darker green in colour than those of trees on the control plot.

Red, White, and Chestnut Oak, Red Maple and Aspen made fairly satisfactory growth in nitrogen-deficient soils, and approached maximum radial increment at a significantly lower relative nitrogen supply than any of the other trees studied. Beech, Sugar Maple, Pignut Hickory, and Black Gum appeared to be intermediate in the scale of nitrogen-deficiency tolerance. Such species as Yellow Poplar, White Ash, and Basswood made poor growth in nitrogen-deficient soils and approached maximum growth only at very high levels of nitrogen availability.

A high degree of correlation was observed between tree growth and internal (leaf) nitrogen concentration. The method of leaf analysis was used to evaluate the relative nitrogen-supplying capacity of soils on which the different series of plots were located, and the relative merits of leaf analysis and direct soil analysis are discussed. Data on the relations between soil nitrogen supply and stand growth and composition are discussed in relation to silvicultural practices in stands on sites of low nitrogen availability. *From authors' summary.*

21.4 : 12.11 : 12.15 : 12.2. Reed, J. F. **Root and shoot growth of Shortleaf and Loblolly Pines in relation to certain environmental conditions.** *Bull. Duke Univ. Sch. For.* No. 4, 1939. pp. 52. [Durham, N.C.]

The curves of average daily root growth were similar for both Shortleaf and Loblolly Pine; the total root growth over a period of 16 months averaged 47·4 in. for each root of Loblolly Pine and 26·2 in. for Shortleaf Pine. Root growth did not cease entirely even during the coldest winter weather. The evidence suggests that root growth may be limited by deficient soil moisture in summer and low soil temperature in winter. The curves of average daily shoot growth were similar for the two species during 1935 and both species produced an average of three whorls of branches during the growing season. Temperature is the factor which controls the seasonal course of shoot growth of both Shortleaf and Loblolly Pines. Night growth of both species was found to be nearly twice as great as day growth and this difference was related more closely to differences between day and night evaporation than to any other environmental factor studied.

21.5 : 23.26.2. Ivashchenko, A. I. **Propagating *Eucalyptus* by cuttings.** *Sovetsk. Subtrop.* 1939, No. 4 (56), (83–4). [R.] Hort. Abs. 9 (165).

Cuttings 5–6 cm. long with 5–7 leaves were taken in the spring from 7-months-old seedlings and planted in sand to a depth of 1·5 cm. Before planting some of the lower leaves were removed. Excessive watering was avoided. The prevailing air temperature was 20–22° C. in the day and about 8° C. at night. The cuttings started to root in the beginning of May, and when rooting was complete they were transplanted to pots, the whole process taking about 50 days. The number of cuttings rooted was 20 per cent. in *Eucalyptus urnigera* Hook., 40 per cent. in *E. tereticornis* Sm., 4 per cent. in *E. cinerea* F.M., and 38 per cent. in *E. rudis* Endl.

21.5 : 23.26.2. Simon, P. G. **Vegetative propagation of *Symphorema luzonicum*.** *Philipp. J. For.* 2, 1939 (267–75). [Bureau of Forestry, Philippines.]

This species can be propagated by cuttings, and propagation should be undertaken in the wet season. Otherwise it is best to plant the cuttings under shade in loose well drained soil. The storage of cuttings is favourable to their growth and the formation of shoots. Cuttings may be shipped without harm, though storage should not exceed a month and they should be packed in moist peat moss under an average temperature of 80·5° F. Termites are very destructive to the cuttings.

21.6 : 24.5. Krotkevich, P. G. **Natural pruning of Pine.** *Lesnoe Khozyaystvo, Moscow* 1939 (10), (29–33). [R.]

Investigations in the Ukraine showed that the natural pruning of Pine was very incomplete. In stands 100 years old, of quality class 1 and density over 0·7, even the bottom third of the stem still retained 25–30 per cent. of its dead branches. Hence the necessity to keep higher-quality Pine stands as dense as possible until the age of 40, and to practise artificial pruning where it is economically possible.

21.6 : 56. Pearson, G. A. **Increment and mortality of Ponderosa Pine in relation to**

diameter. *Res. Note Southwestern For. & Range Exp. Sta.* No. 39. 1938. pp. 5.

Mortality data have been obtained from plots 455 and 480 acres in extent and over periods of 20 and 25 years respectively, all trees on these plots being in good physical condition at the time the record was started. It has been found that annual per cent. of loss is more than twice as high in the diameter group over 30 in. as in the 21–30 in. group, and that wind, lightning, and mistletoe are the main causes of death. Mortality and increment per cent. curves based on the 1913 volume cross each other at the size class of 32 in. d.b.h., indicating that at this point increment is balanced by mortality and that beyond 32 in. the loss exceeds growth. Taking into account both increment and mortality, trees of relatively small size yield the highest returns on the wood capital. Proper management should aim at building up relatively young, fully stocked stands of Ponderosa Pine in which diameter classes are so distributed that cutting operations will leave an adequate growing stock of trees below 26 in. d.b.h.

22. SYSTEMS OF MANAGEMENT. FORMS OF STAND. [SILVICULTURAL SYSTEMS]

22 : 24 : 12.2 (45). MARIANI, G. Il trattamento delle pinete del Carso. [**The treatment of the Pine woods of the Carso.**] *Riv. for. ital.* 1, 1939 (495–8). [It.]

A thinning technique in *Pinus nigra* stands and their conversion into *Abies cephalonica* or *A. alba* woods.

22.12 : 23.11 : 12.2 (44). RUBAN, Y. Le traitement en futaie du chêne rouvre, mélangé au hêtre, méthodes appliquées, résultats obtenus. [**The treatment of high forest of Sessile Oak mixed with Beech : methods used and results obtained.**] *Rev. Eaux For.* 77, 1939 (837–45). [F.]

22.14 : 24 (77). EYRE, F. H. **Silvicultural management of northern hardwoods.** *J. For.* 37, 1939 (719–21).

23. FORMATION OF STANDS

23 : 11.4 (485 : 489). TAMM, O. Om danska hedar och svenska. [**On Danish and Swedish heathlands.**] *Skogen* 26, 1939 (363–6). [Sw.]

Heathlands in Denmark and Sweden are compared with a view to adapting to Swedish conditions the results of Danish experiments in the afforestation of such areas [*For. Abs.* 1 (163)]. Danish *Calluna* heaths are of two main types. Type 1 occurs on coarse-grained sands extremely poor in mineral nutrients; the soil is strongly podsolized, a condition dating probably from the late Neolithic or Bronze Age, and a soft pan has been formed. The special difficulties in afforesting such areas are apparently due to peculiar humus conditions rather than to the pan, which normally presents no obstacle to root development. Type 2 is of a better character; podsolization is slight and apparently of recent origin, and the pan is replaced by a loose brown ferruginous earth. The patches of *Calluna* are interspersed with herbaceous vegetation, and no special trouble is experienced in raising plantations. Swedish heathlands are of four main types: (*a*) The *Calluna* heaths of south-western Sweden resemble the second type of Danish heaths. Spruce often suffers a period of stagnation before achieving normal growth, but Scots Pine does well from the start. When periodical burning is prevented, the heath slowly reverts to woodland. (*b*) The southern Swedish Pine heaths show the closest approach to the Danish type 1. They probably originated from the partial clearing of Pine woods with a ground flora of mosses and Blaeberry. Since they occupy only a small percentage of the forest area, the intensive measures used in Denmark would not be economically justified, but success should attend the use of Spruce and Birch on the better and Spruce and Mountain Pine on the poorer sites in admixture with Scots Pine. Scots Pine must remain the chief species on account of its economic value. (*c*) The southern Swedish Pine woods on the poorer sites, having a ground flora of mosses, are liable to degenerate into heathland wherever large gaps occur. Their character probably corresponds to that of the original woodland of the Danish type 1 before degeneration set in. The dominant species is Scots Pine, with some admixture of Spruce and Birch. These areas are much commoner than the Pine heaths. In regenerating gaps, Spruce and Birch should be encouraged to come in with the Pine, and clear-felled areas should be regenerated before the soil deteriorates and heath vegetation establishes itself. (*d*) The occurrence of the last type, the northern Swedish Pine heaths, is determined by a variety of factors that are still not fully understood. Here, too, an admixture of Spruce and Birch might improve humus conditions, but the admixed

trees should not be allowed to reduce the increment of the Scots Pine, especially as in this region Spruce and Birch do not thrive well enough to be of much economic importance.

23 : 12.2 (68.9). WILLAN, R. G. M. ***Chlorophora excelsa* in Nyasaland.** *Emp. For. J.* 18, 1939 (252–3).

Chlorophora excelsa occurs sparingly on the Lake Nyasa plain or at the base of the foot-hills that fringe it in the South Nyasa, Dedza, and West Nyasa districts of Nyasaland. At one time it was probably far commoner in suitable localities, but cultivation of the relatively fertile land on which it grows and its value as a timber for canoe making have led to its disappearance. In 1936 seed was collected and sown, and in 1938 the 50 seedlings so raised were planted out as old stump plants in the Mua-Livulezi Reserve, where they are doing well, being now 4–5 ft. high after one complete growing season. No traces have been found in Nyasaland of the gall fly, *Phytolyma lata*, which does great damage to the species in Nigeria. Further planting on suitable sites should be successful and would serve a useful purpose in Nyasaland, where timber of any kind is in great demand.

23.1. *Natural Formation of Stands*

23.1 : 12.2 (54.2). SMYTHIES; E. A. **Sal regeneration *de novo*.** *Indian For.* 65, 1939 (614–21). [Forest Department, Naini Tal, U.P., India.]

The optimum conditions for *de novo* Sal regeneration in the Bhabar Sal Working Circle are defined. With the optimum conditions of soil, weed growth, and canopy, and with average luck in synchronizing good seed years and favourable climatic conditions, adequate *de novo* regeneration may be expected to reach the 20-in. stage within a decade or so. The silvicultural measures considered most likely to produce the optimum conditions are indicated.

23.1–2 : 22 : 12.2 (59.1). BARRETT, H. B. **Note on Mohnyin Reserve, Mitkyina Division.** *Indian For.* 65, 1939 [550–8]. [Forest Department, Rangoon, Burma.]

A discussion of past and present management and of experience with natural and artificial regeneration on the Mohnyin Reserve, in the wet zone of Upper Burma. Two characteristics of the present moist type—the difficulty of obtaining natural regeneration of Teak and the invasion of the understorey by evergreen species—are ascribed to the spread of cultivation, which has resulted in dense mists in the outer part of the forest and constant cold, damp air penetrating the forest proper, and to fire protection, which favours evergreen as against deciduous forest. It appears that, apart from plantations, the most likely way of obtaining Teak regeneration is by forest draining and by doing without fire protection.

23.13 : 42 (494). GUT, R. C. Le rajeunissement sous tutelle. [**Regeneration under protection.**] *J. for. suisse.* 90, 1939 (165–74). [F.]

The author discusses means of protecting regeneration in mountainous country against snow and rolling stones. According to observations in the Ormont valley, Switzerland, conifers afforded more satisfactory protection than broad-leaved trees. Silver Fir and Spruce regeneration succeeded well under any coniferous cover, and no confirmation could be found for the so-called 'alternation of generations' theory as applied to these two species.

23.13. WOOD, O. M. **Reproduction of Shortleaf Pine following mechanical treatment of the seedbed.** *J. For.* 37, 1939 (813–14). [Allegheny Forest Exp. Sta.]

The mechanical breaking up or scalping off of the turfy layer of the forest floor and exposure of the mineral soil resulted in establishment of natural regeneration of Shortleaf Pine under a stand of the Shortleaf Pine–Oak mixture on the coastal plain of New Jersey. Raking the litter was not effective.

23.2. *Artificial Formation of Stands. Artificial Regeneration*

23.21. Choice of Species

23.21 : 21 : 12.15 (47). ARTSŸBASHEV, D. D. **Investigations on the acclimatization of new, valuable species.** *Lesnoe Khozyaystvo, Moscow* 1939 (9), (16–22). [R.]

In Russian experience the direct transference of exotic species to their new habitat has seldom proved successful. A more useful method is that of gradual acclimatization on the basis of the 'geographic steps' system as originally formulated by the author, by which exotics are cultivated through several generations under decreasingly favourable climatic conditions so that the seed employed finally in the new habitat is the product of several selections. In the

course of such a process, various measures may have to be adopted to protect the trees from frost, such as the covering of seedlings during winter, and keeping the crowns of broadleaved species as high above the soil surface as possible, either by pruning or by other suitable means. Pruning has been employed on the forest steppe in Russia since 1910 for Chestnut, Walnut, &c., and is also used at the present time for False Acacia, Hornbeam, sensitive Maple varieties, and several subtropical species. It is justified by the observation that (1) during severe frosts in calm weather the air temperature under the crowns is often considerably lower in the layer near the soil than 1·25 to 2·5 cm. above that layer (according to French and Soviet meteorological research), and that (2) the extent to which branches suffer from frost damage is inversely proportional to their diameter, the main stem being least affected (according to the American citrologist Hume). Examples of acclimatization by 'geographical steps' include (*a*) *Thuja plicata*, the seed of which was procured in Alaska in 1909 by the Tigershtedts (father and son) and produced well developed stands in Mustila, Finland (60° 44′ north latitude). These in turn furnished the seed for the Moscow plantations, and it is hoped to cultivate the species in the southern and central chernozem regions in the near future. (*b*) *Robinia luxurians*, *Amorpha fruticosa*, and a few other broadleaved exotics, which are being successfully acclimatized in Moscow after having passed through several 'geographic steps'. A short review is included of successful acclimatization work by the Tigershtedts and the author with *Abies mariesii*, *A. amabilis*, and Douglas Fir, especially var. *caesia*; by the author with Ponderosa Pine; by Shestakov with Canadian Hemlock; and by Eytingen with Lawson's Cypress.

23.21 : 21 : 12.2 (498). Paşcovski, S. Observaţiuni asupra unor esenţe exotice. [**Notes on some exotic trees.**] *Anal. Inst. Cerc. Exp. for.* Ser. 1, Vol. 4, 1938 [1939], (210–30). [Rum.g.]

Notes on *Juniperus virginiana* L., *Platanus acerifolia* Willd., and *Gymnocladus dioica* K. Koch, in the light of Rumanian experience.

23.23. Sowings

23.23–4 (481). Bathen, R. Såing kontra planting. [**Sowing versus planting.**] *Tidsskr. Skogbr.* 47, 1939 (271–5). [Nor.]

Good results were obtained at Troms from patch sowings of Norway Spruce. The best method was to sow in a small mound covered thinly with gravel. Seedlings raised in this manner were not stifled by accumulated litter and escaped frost lift. The author believes that such sowings cost less than planting and may prove to be almost as reliable.

23.23.1. *Seed Procurement, Treatment, and Testing*

23.23.1 : 12.11 (481). Opsahl, W. Skogtrærnes frøsetning 1939. [**The seed production of forest trees in 1939.**] *Tidsskr. Skogbr.* 47, 1939 (401–8). [Nor.]

23.23.1 : 21.5 : 12.2 (54.1). Roy, I. B. **Sopas of Lakhimpur Division [Assam].** *Indian For.* 65, 1939 (621–7). [Forest Department, Shillong, Assam.]

Investigations on the germination and the technique of propagation of six species of Magnoliaceae (known locally as Sopa). The percentages of germination obtained indicate that the species may be used in plantations, particularly if seeds are collected at the right time, sown as early as possible, and properly watered each day. Casualties are few after germination has started and the seedlings grow well. One-year-old plants can be successfully transplanted in winter (November–February). Included are notes on the specific treatment and reaction of *Manglietia insignis*.

Species	*Period of Germination*	*Percentage of Germination*
Talauma phellocarpa	Oct. to Dec.	28
Manglietia insignis	Oct. to Dec.	40
Pachylarnax pleiocarpa	Jan. to March	66
Michelia oblonga	Oct. to Dec.	58
M. montana	Nov. to Feb.	15
M. mannii	Nov. to Feb.	29

23.23.1 (73). McCall, M. A., Silcox, F. A., Myer, D. S., and Wallace, H. A. **Forest seed policy of U.S. Department of Agriculture.** *J. For.* 37, 1939 (820–1).

23.23.1 : 23.26 : 12.2 (74.7). Heit, C. E. **Seed treatment and nursery practice with Cucumber (*Magnolia acuminata*).** *Notes For. Invest.* No. 20. 1939. pp. 2.

The treatment giving best results was: the removal of pulp, the stratification of fresh seed for 5 to 6 months at 36–40° F. in peat moss, spring sowing in a rich soil with top dressing of 5–10–5 commercial fertilizer at 500 lb. per

acre, one-half lath shading until the last part of July, and sprinkling in dry weather. Fall-sown seed should be heavily mulched. Seed stored in sealed bottles at 36–40° F. for one year remained viable.

23.23.1 : 12.2 (74.7). LITTLEFIELD, E. W. **Experimental collection of White Pine cones in August.** *Notes For. Invest.* No. 24. 1939. p. 1.

The collection of White Pine cones from the ground should not be started until after 1st September.

23.23.1 : 12.2 (74.9). MCCLENNEN, F. H. **Further notes on seed productivity of Chestnut Oak in Southern New Jersey.** *Tech. Note Allegheny For. Exp. Sta.* No. 24. 1939. pp. 2.

23.23.1. Guide pour le choix et la préparation de semences forestières de qualité irreprochable. **[Guide to the selection and preparation of forest tree seed of irreproachable quality.]** *J. for. suisse* 90, 1939 (260–7). [F.]

The authors outline the general principles which should govern the choice of trees and stands for the production of quality seed, and the collection, preparation, storage, and testing of seed. Swiss seed supplies are not as strictly regulated as those of Sweden, Finland, and especially Germany. The 'Prescriptions' of 15th December 1932 which assured the use of seed of known source for afforestation work under federal subsidies were of benefit mainly to protection forestry. Otherwise discrimination in the choice of seed has been practised only by the cantons Bern and Grisons and by some individuals. Inferior seed is still used on a large scale in the production forests of Switzerland.

23.23.1 : 12.11 : 12.2. MIROV, N. T., and STOCKWELL, W. P. **Colchicine treatment of Pine seeds.** *J. Hered.* 30, 1939 (389–90). [California Forest and Range Exp. Sta.] O.R.S.

Seeds of *Pinus ponderosa* were kept in moist sand at 5° C. for 3 months, after which they were germinated in a greenhouse, and as soon as the seed-coats split, were placed for 5 days on filter paper wetted with 0·2 per cent. aqueous colchicine solution. Subsequently they were sown in pots and left to develop. The treatment considerably delayed development and produced adverse effects. Some seedlings appeared normal, others were greatly deformed, the majority being weak, with swollen crowns and club-shaped cotyledons. Cell structure was normal in some, while in others various disturbances were noted, including aberrations in the processes of cell division. Chromosome numbers varied from 24 (the normal somatic complement) to about 96, in multiples of 12. Although the results obtained in this experiment have no immediate application, they show that it may yet be possible to produce stable polyploid Pines that can be used in plant breeding.

23.23.1 : 12.2. BORNEBUSCH, C. H. Afsvampning af Bøgeolden. **[Disinfection of Beech mast.]** *Forstl. Forsøgsv. Danm.* 15, 1939 (190–8). [Da.f.]

Experiments during 1933–9 on fungicidal disinfection of Beech mast previous to sowing showed that plant production per number of seeds sown was considerably increased, and frequently almost doubled, as a result of this treatment. Dry disinfection in rotating cylinders, using 0·3 kg. of the inexpensive 'Tillantine 1875' powder per 100 kg. of Beechnuts, is especially recommended.

23.23.1 : 12.2. RIETZ, R. C. **Effect of five kiln temperatures on the germinative capacity of Longleaf Pine seed.** *J. For.* 37, 1939 (960–3). [Forest Products Laboratory, Madison, Wis.]

An experiment in the kiln drying of Longleaf Pine cones, which had been air-dried to a moisture content of 35 per cent. prior to heating, indicated that a kiln temperature of 120° F. is apt to be slightly injurious to the seed. It is therefore suggested that fairly green Longleaf Pine cones be kiln-dried at 115° F. and at relative humidities as low as 20 per cent. *Author's summary.*

23.23.3. *Methods of Sowing*

23.23.3 : 23.24.2–3 : 12.2 (485). ENANDER, M., and HEIJBEL, I. Förb. jägmästarekursens skogsodlingar å Garpenbergs kronopark 1916–1935. **[Plantings carried out in the Garpenberg State Park during preparatory courses for forest officers in 1916–1935.]** *Skogen* 26, 1939 (442–5). [Sw.]

In patch sowings of mixed Scots Pine and Norway Spruce at Garpenberg, on a sandy moraine soil with stones, no advantage was found to result from mixing top soil, subsoil, and humus preparatory to sowing. It is re-

commended that seed patches on loose sandy soils should receive only light superficial treatment before sowing. In spring planting on the same soil, where the water supply in spring and early summer is a limiting factor, some of the plant roots should make contact with undisturbed soil in which capillary movement of water has not been reduced by loosening. Planting holes must therefore be dug in autumn and packed with soil before the spring planting; in planting, the roots are placed against a vertical wall that has remained undisturbed throughout the spring. The best results were obtained from mixed plantings of 1 Pine and 1 Spruce per planting hole, the respective ages of the Pine and Spruce transplants being adjusted either to equalize differences in speed of growth or to utilize such differences as a means of securing the dominance of one of the species. Pine raised in this way is naturally pruned by the adjacent Spruce and is of better quality than when Pine and Spruce are raised in alternate rows, in zigzag formation, or by patch sowings. The method is also said to reduce the risk of damage by elk and grazing animals.

23.23.3 (78–9). SCHOPMEYER, C. S. **Direct seeding in the Western White Pine type.** *Appl. For. Notes Northern Rocky Mt. For. & Range Exp. Sta.* No. 90. 1939. pp. 10.

Plots established in the fall of 1937 and the spring of 1938 on clear-cut and burned-over areas in the Kaniksu national forest (Washington) and the Cœur d'Alene national forest (Idaho), were sown with Ponderosa Pine, Western White Pine, and Engelmann Spruce. In screened spots fall sowing resulted in an average germination of over 60 per cent. for all species, whereas germination of spring-sown seed was in no case over 25 per cent. There was an average of less than one germinated seed of Western White Pine or Ponderosa Pine per unscreened spot, for both spring- and fall-sown plots, as a result of rodent depredation. Apparently the small seed of Engelmann Spruce was not so attractive to the rodents.

Causes of mortality up to the end of the first growing season, in decreasing order of destructiveness, were cutting by biotic agents, drought and insolation combined, and damping-off. Losses due to cutting, and to drought and insolation combined, were greatest for Engelmann Spruce, intermediate for Western White Pine, and least for Ponderosa Pine, whereas damping-off seemed much the same for all species. Drought and insolation losses were correlated inversely with the relative depth of root penetration, which in the case of Engelmann Spruce and Western White Pine was greater from fall-sown seed than from spring-sown seed, while the opposite was true for Ponderosa Pine.

From this investigation it appears that the direct sowing of Western White Pine and Ponderosa Pine should be made in the fall under protection from rodents; that the latter species, with a root penetration of between 15 and 18 in. during the first growing season, is the better adapted of the two for the survival on dry sites; and that Engelmann Spruce should be sown in the fall when possible and limited to moist sites. Screening is not so important for the last-named species, particularly when sowing is done on a favourable site.

23.23.3 : 45.1 (79.1). KRAUCH, H. **Seedlings safe from rodent destruction after a year's protection.** *Res. Note Southwestern For. & Range Exp. Sta.* No. 43. 1938. pp. 5.

Results from a seed-spotting experiment indicate that reforestation by direct sowing can be successful in this region if rodents are effectively controlled, particularly during the first year after sowing. Douglas Fir, Ponderosa Pine, and Limber Pine were the species used in the experiment, and the seed spots were protected with galvanized hardware-cloth screens.

23.23.3 : 12.2 (79.5 : 79.7). ISAAC, L. A. **Reforestation by broadcast seeding with small-seeded species.** *For. Res. Notes Pacific Northwest For. Exp. Sta.* No. 27. 1939 (9).

Although there was wide variation in the results from these tests with seed of Sitka Spruce, Western Red Cedar, Western Hemlock, and Red Alder, it appears that satisfactory regeneration can be obtained by broadcast seeding at the rate of one or two pounds per acre, as long as the seeding is done within two years after slash burning. If postponed longer there is a considerable falling off in initial germination and in survival.

23.23.3. TINSLEY, S. L. **Direct seeding—a revival.** *J. For.* 37, 1939 (888–90). [Soil Conservation Service, Freehold, N.J.]

Experiments with Ponderosa and Western White Pine indicate two factors that significantly influence the success of direct seeding with these species: (1) the stratification of spring-sown seed, and (2) the protection of seed spots from rodent depredations.

23.23.3 : 45. KRAUCH, H. **Does screening of seed spots do more than protect the spots against rodents and birds?** *Res. Note South-western For. & Range Exp. Sta.* No. 49. 1938. pp. 4.

The most effective screening device was found to be a quart oil can open at both ends, or a cellophane cylinder, sunk part way in the ground with the seed sown inside, and covered by a cone-shaped hardware-cloth screen. From experimental data on the mortality of 1-year seedlings of Douglas Fir, Ponderosa Pine, and White Pine, in cellophane cylinder only, and in cellophane cylinder plus screen, it appears that the screening has some sort of ameliorating effect on physical factors, probably in relation to heat deflection.

23.24. Formation of Crops (Stands) by Planting

23.24 : 12.2 (43.9). FORGÁCH, B. Az akác tenyésztése a nyirségi futóhomokon. [**The cultivation of *Robinia* on the shifting sands of the Nyirseg district.**] *Erdész. Lap.* 78, 1939 (973–87). [Hu.g.f.e.]

Wide spacing of seedlings combined with several years of agricultural cropping between plantation rows, using vegetable species that require hoeing, resulted in an increased timber yield of 80–100 per cent. from *Robinia* grown on a 25-year rotation. In the 5 years following the clear cutting of the trees, the improved soil fertility was shown by a relatively high agricultural yield.

23.24 : 23.21 (73). MAISSUROW, D. K. **Mixed group planting on the Nicolet National Forest.** *J. For.* 37, 1939 (853–5).

Jack, Red, and White Pines and other coniferous species have different requirements as to vegetation cover on the plantation site during establishment. On areas of uniform site but lacking a uniform cover, two or three species of different cover requirements are mixed in groups, according to the location and density of protective vegetation and the cover requirements of the species planted. Planting is done in one operation and the number of trees of each species to be planted is determined from the 'percentage of cover' figures obtained during planting reconnaissance surveys. Survival and growth of seedlings appear to be favoured by this method in comparison with the straight planting of one species, and the cost per acre of plantation establishment is relatively lower for mixed group planting.

23.24 : 12.2(74.7). LITTLEFIELD, E. W. **Planting results with Jack Pine stock.** *Notes For. Invest.* No. 19. 1939. pp. 2.

Two blocks of about 450 and 300 seedlings respectively of 2–0 and 1–0 stock were planted side by side on a north-facing slope covered with light grass, the 2–0 stock growing on somewhat thinner soil and in part more exposed to severe wind. Differences in size of stock were no longer apparent at the end of the fourth growing season, and after five growing seasons (1938) survival tests gave 92 per cent. for the 2–0 stock and 96 per cent. for the 1–0 stock, with average heights of 4·3 ft. and 4·2 ft. respectively.

23.24 : 23.26.2 (74.7). LITTLEFIELD, E. W. **Results of a planting experiment with Red Pine stock of various ages.** *Notes For. Invest.* No. 21. 1939. pp. 2.

This experiment indicates that transplanting of Red Pine in the nursery is not an essential measure for the production of a good plantation. Three-year seedlings that have been root pruned at the beginning of the 2nd and 3rd years, and grown in a seedbed at low density, compare favourably with transplants in survival and growth, and show a somewhat higher resistance to frost heaving.

23.24 : 11.44 : 12.19. DAY, M. W. **The influence of some ground cover types upon tree seedling survival.** *Quart. Bull. Mich. agric. Exp. Sta.* 22, 1939 (105–9). [Section of Forestry, Michigan Agricultural Exp. Sta.]

An experimental planting of White Pine, Red Pine, Jack Pine, White Spruce, and European Larch was made on the cover types identified with the species Quack Grass (*Agropyrum repens*), Polytrichum moss (*Polytrichum* spp.), and Dewberry (*Rubus villosus*) respectively. The Dewberry type indicated the best planting site and gave the best results as regards both survival and growth. Site differences appeared to be correlated with height of water table.

23.24 : 23.26 : 12.2. MOHAN, N. P. **Artificial regeneration of *Wendlandia exserta* D.C.** *Indian For.* 65, 1939 (725–30).

The most satisfactory germination of seed resulted from that collected at the end of May or 1st of June, sown in pots or boxes, and lightly covered with soil which should be dis-

turbed on the seventh day after sowing. The soil surface should be kept shaded and should never be allowed to dry up, the watering being done from a can with a very fine rose. Germination takes place at the end of 8 days and when the seedlings are 1–2 in. high they are pricked out in pots and planted the following year.

23.24.1 : 23.24.4. Briggs, A. H. **Report of planting experiment to determine the effect of root exposure on deciduous planting stock.** *J. For.* 37, 1939 (939–43). [Prairie States Forestry Project.]

This study indicates that moderate exposure of the roots of dormant deciduous seedlings is not detrimental to survival, that fully dormant seedlings are less susceptible to injury from drying than those breaking dormancy, and that there is little difference in susceptibility to injury between fresh fall-dug seedlings and those that have wintered in the heel-in bed.

23.24.2–3 (77.4). Kroodsma, R. F. **Comments on 'Why forest plantations fail'.** *J. For.* 37, 1939 (822–3).

Discussion of an article dealing with a study of the factors causing mortality in Pine plantations in lower Michigan [*For. Abs.* 1, (162)]. It is pointed out that slit planting, a method much less costly than hole planting, has given satisfaction in many plantations established in Michigan prior to 1936. It is suggested that, in relation to seedling and sapling mortality, depth of roots may be just as critical a factor as root position.

23.24.2–3 : 12.2 (921). Tuyt, P. Schaduwrijen cultuur van ijzerhout in de Residentie Palembang. [**Strip planting of Ironwood in the Residency of Palembang.**] *Tectona* 32, 1939 (805–28). [Du.e.]

Ironwood (*Eusideroxylon zwageri*) is a shade-bearing species that grows well on damp soils. Successful regeneration has been obtained in an old natural stand by means of regeneration fellings, but strip planting under the shelter of old belukar or high virgin forest has proved the most satisfactory way of raising fresh stands. The seed, which takes 4–10 months to germinate, should be sown in nursery beds laid out in virgin forest, in a fairly damp place. No further attention is then needed until the seedlings acquire leaves, after which transplanting may be carried out at any time during the rainy season between October and April. Seedling stock must be planted under old, dense belukar or high virgin forest: in no case should plantings be made in young, open belukar or lalang grass. The planting rows should be laid out in an E.–W. direction, to avoid excessive insolation at first. Plants should be spaced at intervals of 2 m. in rows 5 m. apart from centre to centre, the breadth of the prepared ground in each row being 1·5 m. For the first 4 years the rows must be kept clean. Overhead cover must be removed during the succeeding 4 years by poison-girdling the nurse trees with sodium arsenite. All side cover must be cleared before the 12th year. After 10–12 years the young trees begin to close canopy, and the first thinnings may be made. Plantations raised in this way have cost 14 florins per ha., including nursery expenses.

23.26. Plant Rearing. Nursery Practice

23.26 : 12.2 (47.6). Nikitin, I. N. **The cultivation of *Betula schmidtii* in the neighbourhood of Leningrad.** *Lesnoe Khozyaystvo, Moscow* 1939 (8), (30–3). [R.]

Notes on germination and early development. Acclimatization experiments begun in 1937 have been successful thus far.

23.26 : 94.3 (481). Føyn, P. Lokale planteskoler for selvforsyning. [**Local nurseries for home supplies.**] *Tidsskr. Skogbr.* 47, 1939 (284–7). [Nor.]

The author suggests that the nursery beds should be worked on a rotation, tree seedlings and vegetable crops being grown alternately. Such use of the ground is said to reduce the danger of disease, insect attack, and soil fatigue. Manuring should precede the vegetable crop, so that weeds encouraged by the fertilizer may be eliminated before tree seedlings are grown.

23.26.1. *Description of Different Nursery Methods*

23.26.1 : 12.2. **Thinning of conifer seedlings in the nursery produces bigger but fewer plantable trees.** *Tech. Note Lake States For. Exp. Sta.* No. 143. 1939. p. 1.

Results of experiments with *Pinus strobus* and *P. resinosa*. The desired seedling density should be attained by reducing the amount of seed rather than by thinning.

23.26.1 : 12.2. **Top-pruning of conifer stock a doubtful operation.** *Tech. Note Lake States For. Exp. Sta.* No. 145. 1939. p. 1.

Mortality was considerably increased by top-pruning coniferous nursery stock just before planting out. Top-pruning some months in advance of planting gave no significant difference in survival.

23.26.3. *Transplanting*

23.26.3. Parente, E. La tecnica del trapianto nei vivai forestali. **[The technique of transplanting in forest nurseries.]** *Riv. for. ital.* 1, 1939 (608–10). [It.]

Technique of lifting seedlings by spade.

23.26.5. *Treatment with Growth Substances*

23.26.5. Chadwick, L. C., and Kiplinger, D. C. **The effect of synthetic growth substances on the rooting and subsequent growth of ornamental plants.** *Bi-m. Bull. Ohio agric. Exp. Sta.* 24, 1939 (89–95). [Ohio Agricultural Exp. Sta.]

Hardwood cuttings did not respond favourably to treatment with indole-butyric acid or naphthalene-acetic acid, the latter applied both in solution and in mixture with a dust. The treatment of softwood cuttings of greenhouse and woody ornamental plants, and of mature cuttings of species and varieties of *Juniperus*, *Thuja*, and *Taxus*, hastened rooting and produced a superior root system without, however, affecting the position of roots on plants which exhibit specific rooting habits. In general, plants difficult to propagate by cuttings were not improved to the extent of making treatment with growth substances commercially feasible.

23.26.5. Evenari, M. [Schwarz, W.], Konis, E., and Zirkin, D. **The effect of heteroauxin on root formation by cuttings and on grafting. Pt. II.** *Palest. J. Bot. [Jer. Ser.]* 1, 1938 (125–30).

The results of experiments in applying β-indole-acetic acid to summer cuttings of *Bignonia capensis*, *Ficus nitida*, *Pyrus malus* var. 'Hashabi', *Hibiscus rosa-sinensis*, *Ligustrum japonicum*, *L. ovalifolium*, *Lonicera japonica Myrtus communis*, *Cupressus horizontalis*, *Thuja orientalis*, *Laurus nobilis*, and *Olea europaea*. While lanolin preparations failed entirely to stimulate rooting, treatment with solutions, especially with those of a concentration of 15–25 mg. per 100 c.c. of water, was effective. Additions of nutritive substances, such as sugar, to the solution had a favourable influence on rooting. No treatment whatsoever induced rooting in *Laurus nobilis*, *Thuja orientalis*, and *Cupressus horizontalis*. [Note *For. Abs.* 1, (136) for reference to previous results using leafless spring cuttings.]

23.26.5 : 12.11 : 12.2 : 21.5. Farrar, J. L. **Rooting of Norway Spruce cuttings.** *For. Chron.* 15, 1939 (152–63).

23.26.5 : 21.5 : 12.11 : 12.2. Deuber, C. G., and Farrar, J. L. **Rooting Norway Spruce cuttings.** *Amer. Nurseryman* 70, 1939 (3–5). [Osborn Botanical Laboratory, Yale University.]

An investigation of the rooting responses of stem cuttings from 39-year-old Norway Spruce using the apical ends of normal lateral branches within 10 ft. of the ground, and cut just behind the second whorl of twigs. Cuttings were of two size classes, 2–4 in. and 4–8 in., collected in October, November, December, and January and separated as controls, treated with tap water, and treated with 8 different concentrations of indole-butyric acid. Examination of cuttings 7 and 14 weeks after treatment indicated that: (1) A high percentage of dormant cuttings rooted during the winter months. (2) Rooted cuttings could be transplanted outside in April and May. (3) December was the best month to collect cuttings, and if they were taken from mature trees at that time, 90 per cent. rooting resulted. (4) Longer cuttings of the most recently formed wood gave best results. (5) Initial treatments with tap water and indole-butyric acid solutions inhibited rooting. (6) The best results were obtained by planting freshly made cuttings directly in sand.

23.26.5 : 12.2. Snow, A. G. **Chemically-induced rooting of Sugar Maple cuttings.** *Tech. Note Northeastern For. Exp. Sta.* No. 27. 1939. p. 1.

The maximum rooting of cuttings, secured about the middle of June, was obtained with a 3-hour treatment with indole-butyric acid at a concentration of 50 milligrams per litre.

23.26.5 : 21.5 : 12.11. Baptist, E. D. C. **Plant hormones.** *J. Rubb. Res. Inst. Malaya* 9, 1939 (17–39).

A brief survey of the literature on this subject and a discussion of the functions of hormones in plants. The results of preliminary experiments in the treatment of *Hevea brasiliensis* with hormones are recorded.

23.26.5 : 21.5. Chouard, P. Les hormones de croissance et leur emploi pratique, spécialement

dans le bouturage. [**Growth hormones and their practical use, especially with cuttings.**] *Rev. Bot. appl.* 19, 1939 (255–70, 332–50). [F.] Hort. Abs. 9 (200).

A summary of work to date.

23.26.5 : 21.5 : 12.2. Grace, N. H. **Vegetative propagation of conifers. II. Effects of nutrient solution and phytohormone dusts on the rooting of Norway Spruce cuttings.** *Canad. J. Res.* 17, 1939 (312–16). P.R.

Norway Spruce cuttings were treated with phytohormone dust, and nutrient solution was added to the sand in which some of the cuttings were planted. The nutrient treatment greatly increased the number of rooted cuttings and the number that developed new growth, and reduced the number that died. *From author's summary.*

23.26.5 : 21.5 : 12.11. Grace, N. H. **Physiological activity of a series of indolyl acids.** *Canad. J. Res.* 17, Sec. C. 1939 (373–5). [National Research Laboratories, Ottawa.] P.R.

The physiological activity of a series of indolyl acids, from the acetic to the valeric, including 5-methyl-indolylpropionic, has been determined by the rooting responses of *Lonicera tartarica* cuttings treated with solutions of each. Indolylbutyric acid was the most active chemical, affecting the number and length of roots per rooted cutting, the mean root length, the green weight of leaves, and the fresh root weights. Indolylacetic acid had significant effects on the number and length of roots per rooted cutting. Slight activity was shown by indolylpropionic acid, but neither indolylvaleric acid nor 5-methyl-indolylpropionic showed any significant treatment effects. None of the acids affected the number of cuttings rooted. *Author's summary.*

23.26.5 : 21.5 : 12.2. Grace, N. H. **Vegetative propagation of conifers. III. Effect of month of collection on the rooting of dormant Norway Spruce cuttings.** *Canad. J. Res.* 17, Sec. C. 1939 (376–9). [National Research Laboratories, Ottawa.] P.R.

In a comparison of the rooting responses of cuttings of Norway Spruce from upper branches, in which one lot was stored under snow from November until early April and the other collected in late March, there were statistically significant differences. After 12 weeks 38·9 per cent. of the November and 20·7 per cent. of the March cuttings were rooted or calloused. At the end of the propagation period 45·2 per cent. of the November and 66·6 per cent. of the March cuttings were dead. Indolylacetic acid dust treatment did not have a significant effect on the number of cuttings rooted or calloused; it did, however, increase the number that were dead at the end of the experiment. *Author's summary.*

23.26.5 : 21.5. Hitchcock, A. E., and Zimmerman, P. W. **Comparative activity of root-inducing substances and methods for treating cuttings.** *Contr. Boyce Thompson Inst.* 10, 1939 (461–80).

Cuttings were treated with root-inducing substances in dilute and concentrated solutions and as powders. Concentration requirements for optimum rooting varied with the substance and carrier used, with the species, age and condition of cutting, and with the time of year and method of treatment. Potassium salts were consistently more effective than indole-acetic, indole-butyric, and naphthalene-acetic acids. Talc controls gave better rooting than the non-treated and tap-water controls.

23.26.5 : 21.5. Oliver, R. W. **Honey as a stimulant to the rooting of cuttings.** *Sci. Agric.* 19, 1939 (586–8). Hort. Abs. 9 (201).

Honey was found to stimulate the rooting of *Thuja occidentalis* var. *pyramidalis* and chrysanthemum. The best treatment was to stand the cuttings in a 25 per cent. solution of honey for 24 hours before planting; the response of cuttings to this treatment was only very slightly below that obtainable from the most favourable hormone treatments. The active substance has not yet been isolated from the honey.

23.26.5 : 21.5. Peace, T. R. **Experiments on the effect of growth substances on the rooting of cuttings of certain woody plants.** *Mss.* 1939. pp. 11. [Forestry Commission.]

During the spring and summer of 1939 experiments were made at Oxford on the rooting of cuttings of 5 trees, *Ulmus* spp., *Rhamnus frangula*, *Populus tremula*, *Pseudotsuga taxifolia*, and *Sequoia sempervirens*. Four frames contained peat sand mixture, with the sand heavily predominating, and the fifth frame contained pure sand. Lack of space and the outbreak of the war precluded definite conclusions being made. The chemicals used were indolyl-butyric acid, Seradix A, indolyl-acetic acid, Auxan, Auxan *plus* vitamin B_1, β naphthalene-acetic acid, naphthalene-acetic acid derivative, and

Belvitan; the solutions were all in water, though in some cases ethyl alcohol was used to dissolve the substance.

Good results were generally procured with the lower strengths of indolyl-acetic acid in solution, with the higher strength of naphthalene-acetic acid derivative, with Auxan, indolyl-acetic acid, and indolyl-butyric acid in talc. Type of cutting and general treatment are probably even more important than the chemical treatment. The behaviour of the cuttings after rooting was not investigated. Elm and *Rhamnus* cuttings of the spring series were almost certainly sufficiently established to survive the winter. All the summer cuttings and the conifer cuttings of the spring series would have had to remain in the frames during the winter.

23.26.5 : 21.5. STOUTEMYER, V. T. **Talc as a carrier of substances inducing root formation in softwood cuttings.** *Proc. Amer. Soc. hort. Sci.* 36, 1938 [1939] (817–22). [U.S. Plant Introduction Garden, Glenn Dale, Md.] E.M.B.

Cuttings of a range of species that require widely different dosages of growth substances in aqueous solution were tested for their response to the same substances applied in various concentrations as dusts with a talc base. The latter treatment was quite as effective as the former, and gave a greater latitude of dosage, although certain concentrations were still optimal for each species. No ideal can be laid down for use with all species, but a concentration of 1 : 1,000 would seem to be a good general-purpose dust. The method of preparing the dusts and certain precautions in their application to the cuttings are described. The cuttings are simply wetted, dipped to a depth of about 1 cm. in the dust, several at a time, and planted immediately. Advantages of the method are that considerable savings are made in material and time, and that no dosage charts or apparatus are necessary, so that relatively unskilled workers can be trusted to perform the treatment satisfactorily. Taken in conjunction with the efficiency of the treatment, which gave good results with some very difficult subjects, these advantages should render the method preferable to treatment with growth substances in aqueous solutions, except possibly for certain special cases.

23.26.5 : 23.23.1 : 12.2. SMITH, P. F. **The influence of 3-indole-acetic acid on pollen germination.** *Science* 90, 1939 (163–4). [University of Oklahoma.]

A 1 : 1,000,000 solution stimulated the pollen of *Pinus austriaca* to germinate within 6 hours (51 per cent. germination) whereas no germination occurred in the control.

23.26.5 : 23.25 : 21.5. METCALFE, C. R., and TEMPLEMAN, W. G. **Experiments with plant growth substances for the rooting of cuttings.** *Kew Bull.* 8, 1939 (441–56).

168 plant and tree species were treated with: (1) water, (2) β-indolyl-acetic acid at 20 mg./litre, (3) β-indolyl-acetic acid at 50 mg./litre, (4) β-indolyl-butyric acid at 20 mg./litre, (5) β-indolyl-butyric acid at 50 mg./litre, (6) β-naphthyl-acetic acid at 20 mg./litre, and (7) β-naphthyl-acetic acid at 50 mg./litre. Among the species that responded to one or other of the treatments are included *Cornus nuttallii*, *Garrya elliptica*, *Magnolia soulangeana* var., *Nothofagus* sp., *Parrottia persica*, *Quercus engleriana*, and *Stewartia* spp. Among the species that failed to respond to any treatment are *Carrierea calycina*, *Cotinus americanus*, *Erica arborea* var., *Feijoa sellowiana*, *Melliosma* sp., *Nyssa* sp., and *Tsuga* sp.

23.26.7. *Damage in nurseries and methods of protection*

23.26.7. LAMONT, C. **Hedges in forest nurseries.** *Forestry* 13, 1939 (113–17).

Notes are given on the growth and habit of the following, with particular reference to their value as hedges and windbreaks: Privets, Yew, Elm, Laurel, Brooms, *Lonicera nitida*, *Olearia haastii*, Sea Buckthorn, *Osmanthus aquifolium*, Hollies, Box, Beech, *Ribes*, *Sambucus*, *Rosa* spp., *Pyracantha* spp., Cotoneasters, *Escallonia* spp., *Berberis* spp., Rhododendrons, and conifers.

23.26.7 : 11.47. FOWELLS, H. A., and ARNOLD, R. K. **Hardware cloth seed-spot screens reduce high surface soil temperatures.** *J. For.* 37, 1939 (821–2).

Experimental data show that cone-shaped screens, 10 in. across the base and 10 in. high, made of 4-mesh, 20-gauge hardware cloth and pressed into the soil to the depth of ½ in., effect a highly significant reduction in the average maximum soil temperature.

23.26.7 : 12.2 : 13.2. DAY, M. W. **Damage to Red Pine nursery stock by the small Pine sawyer.** *Quart. Bull. Mich. agric. Exp. Sta.* 22, 1939 (118).

The small Pine sawyer (*Monochamus scutel-*

latus) damaged 4-year-old Red Pine transplants and 3-year-old seedlings by chewing away the bark and cambium tissues along one side of the leader, thus making the trees useless for planting. Control was effected by hand picking.

23.26.7 : 12.12. ROLDAN, E. F. **Damping-off of seedlings in forest nursery.** *Philipp. J. For.* 2, 1939 (225–33). [Division of Forest Studies and Research Bureau of Forestry, Philippines.]

A humid atmosphere with slight variations in temperature favours the development of damping-off. The disease may prevent germination and in the post-emergence stage often causes seedling mortality. The causal organisms of the disease are soil-borne fungal parasites, and the principal species obtained from about 250 isolations from diseased seedlings were *Pythium* 60 per cent., *Rhizoctonia* 23 per cent., and *Fusarium* 17 per cent. The life-histories of the parasites are discussed. Recommended control measures include: (1) Concentrated sulphuric acid diluted to 1 : 160 and applied at 1 litre per sq. ft. of soil. (2) 40 per cent. commercial formalin diluted to 1 : 100 and applied at 4 litres per sq. ft. (3) Thorough shaking together of cuprous oxide and seeds at the rate of one level teaspoonful of CuO_2 per pound of seed, followed by the application of zinc oxide to the soil surface immediately after planting, at the rate of 15 to 30 gm. per sq. ft. (4) Overcrowding of the seedlings and the presence of too much water in the soil should be avoided.

23.26.7 : 44.3 : 12.2. CARTER, J. C. **Progress in the control of Elm diseases in nurseries.** *Biol. Notes nat. Hist. Survey Div., Illinois*, No. 10. 1939. pp. 19.

The following treatments are recommended for wilt disease of Elm (usually caused by *Phoma*, *Coniothyrium*, *Cytosporina*, or *Vermicularia*), based on tests conducted in commercial nurseries over a number of years. (1) Summer dusting with Kolodust, and pruning. (2) Summer dusting with sulphurs such as flotation sulphur dust and 'Mike' sulphur, with or without pruning. (3) Dormant and summer spraying with instant Bordeaux, and pruning. (4) Summer spraying with 'Mike' sulphur, and pruning.

Kolodust is a commercial sulphur dust containing not less than 87 per cent. sulphur as its active ingredient. 'Mike' sulphur is a commercial wettable sulphur dust containing not less than 95 per cent. sulphur as its active ingredient. Instant Bordeaux is a home-made mixture of copper sulphate powder and dehydrated lime with strength equivalent to a 4–4–50 Bordeaux mixture.

23.26.8. *Preparation of Compost*

23.26.8 (74.7). ELIASON, E. J. **The effect of composted manure after three years in nursery soil.** *Notes For. Invest.* No. 22. 1939. p. 1.

Transplant plots were treated with 2-year-old compost, made of combinations of manure, leaves, muck and superphosphate, at the rate of 10 and 20 tons per acre, each treatment being applied to four plots with 2 untreated plots as controls. Using weed growth as the indicator of soil fertility, it is shown that, for the two years following treatment, the plots treated at the 10-ton rate and at the 20-ton rate produced ten and twenty times, respectively, the weight of weeds produced by the control. The compost was effective for at least three growing seasons.

23.26.8. GILORMINI, J. A. Preparación y uso del mantillo o estiercol compuesto en viveros forestales. **[Preparation and use of compost in forest nurseries.]** *Carib. For.* 1, 1939 (27–8). [Span. e.] [Forest Service, Puerto Rico.]

In preparing the compost heap a layer of fertile soil 10–12 in. deep is followed by layers, 4–7 in. deep, of such materials as manure, grass, litter, &c., with a final topping of 6–10 in. of good soil. Some lime should be added and the heap worked over occasionally, water being added in dry weather. The compost is ready at the end of 8 to 12 months and should be applied previous to bed preparation, the amount varying with condition of nursery soil.

23.26.9. *Other Methods of Manuring or Fertilizing*

23.26.9 : 12.2 (74.6). LUNT, H. A. **The use of fertilizer in the coniferous nursery with special reference to *Pinus resinosa*.** *Bull. Conn. agric. Exp. Sta.* No. 416. 1938. pp. 723–66.

In general, Red Pine and other conifers respond to the application of fertilizers both in the seedbed and in the transplant bed, although in the former case care must be exercised to avoid injury from too high a concentration of soluble materials. Nitrogen is absorbed in the largest amount and should be available in the

soil in the ratio of about ten parts N to four of P_2O_5 and five of K_2O. There is indication that the organic forms of nitrogen, especially fish meal and tankage, are slightly superior to inorganic sources. The kind and amount of fertilizer to use must be governed by the quality of the soil, the age of the nursery stock, and to a certain extent by species. Of the conifers studied, Scots Pine makes the heaviest demands upon the soil, and the Spruces, especially Norway, the least. The dry weight per unit area is a much greater determining factor in nutrient removal than is percentage composition. *From author's summary.*

23.26.9 : 21.3 : 11.47. NĚMEC, A. Vliv jednostranného hnojení fosforečnými hnojivy na výživu sazenic smrku v lesních školkách. VII. Vliv hnojení na resorpci kyseliny křemičité. **[The influence of unbalanced phosphoric acid fertilizing upon the nutrition of Spruce seedlings in forest nurseries. VII. The influence of fertilizing on the uptake of silica.]** *Ann. Acad. tchécosl. Agric.* 14, 1939 (69–77). [Cz.g.] H.S.B.

Manuring with superphosphate and basic slag (Thomas process) had little effect on the SiO_2 needle content, per unit dry weight, in 3-year-old seedlings growing on soils with an adequate content of both P_2O_5 and SiO_2, but SiO_2 absorption was increased in soils deficient in P_2O_5 and/or SiO_2. The SiO_2/P_2O_5 ratio in the needles increased with the acidity of the soil.

23.26.9 : 21.3 : 11.47. NĚMEC, A. Untersuchungen über den Einfluss chlorhaltiger Kalidüngemittel auf das Wachstum und auf die Ernährung der Fichte in Waldbaumschulen. **[Research on the influence of chlorine-containing potash fertilizers upon the growth and nutrition of Spruce in forest nurseries.]** *Bodenk. PflErnähr.* 13, 1939 (35–72). [G.g.] [Institut für forstliche Biochemie und Pedologie der staatlichen forstlichen Forschungsanstalten in Praha-Dejvice.] H.S.B.

Potash salt (about 40 per cent. K_2O content) and Kainite (about 15 per cent. K_2O content) were applied to 1-year transplants in doses corresponding to 1·8 kg. of K_2O per 100 sq.m. and in the following year a second application corresponding to 0·6 kg. of K_2O per 100 sq.m. The effect of the manures, for various soil conditions, was investigated in respect to height growth, mortality, and the absorption by the needles of K_2O, N, P_2O_5, CaO, MgO, MnO, Fe_2O_3, Al_2O_3, and SiO_2. The effect on growth depended primarily on the potash supply in the soil and the soil content of CaO and P_2O_5. For 3-year-old Spruce potash deficiency was found to correspond to a K_2O content (as determined by extractions with 1 per cent. citric acid solution) of less than 130 mg. per kg. in the 20 cm. top layer of soil. In general the manuring had a positive effect on the growth only where soils contained more than 100 mg. of citric-soluble P_2O_5 per kg., and at least 150 mg. of CaO (soluble in a 10 per cent. solution of NH_4Cl) per 100 g. In lime-deficient, acid soils and in those with a high chlorine content the effect was negative. Apparently the chlorophobe behaviour of Spruce was largely responsible for the frequent high mortality following transplanting, which was the more serious the shorter the lapse of time between manuring and transplanting. When Kainite was applied shortly before or after transplanting mortality amounted to 35–45 per cent. or more. It is recommended that potassic fertilizers to be used in Spruce nurseries should not contain chlorine.

23.26.9 : 21.3 : 12.2. NĚMEC, A. Vliv jednostranného hnojení fosforečnými hnojivy na výživu sazenic smrku v lesních školkách. VI. Vliv hnojení na resorpci železa a hliníku. **[The influence of unbalanced phosphoric acid fertilizing upon the nutrition of Spruce seedlings in forest nurseries. VI. The influence of fertilizing on the uptake of iron and aluminium.]** *Ann. Acad. tchécosl. Agric.* 14, 1939 (33–46). [Cz.g.] H.S.B.

In general, manuring with superphosphate and basic slag (Thomas process) resulted in a slight decrease in iron absorption, although iron absorption increased for both manured and control plants with increasing soil acidity. On acid soils manuring generally resulted in decreased aluminium absorption. On phosphorous-deficient soils the manuring increased height growth only in the seedlings with a low Fe_2O_3 needle content. On such soils superphosphate increased height growth only when the aluminium content of the soil and needles was low, whereas the beneficial effect of basic slag was independent of this factor.

23.3. *Afforestation*

23.3 : 23.6 : 44.1 (44). MALLET, J. Reboisements en Provence. **[Reforestation schemes**

in Provence.] *Rev. Eaux For.* 77, 1939 (689–707). [F.]

The results of afforestation experiments, during 1930–4, in Provence, which has a Mediterranean climate, an annual precipitation of 24 in., and calcareous soils, which are usually shallow. Also a discussion of the technique of protecting young plantations, mainly of *Cupressus sempervirens*, from drought and the closely related effects of insolation and strong winds. Stress is laid on the importance of placing seedlings in a soil that is improved and protected by a vegetation which itself does not consume an excessive amount of moisture. Thus, while Gramineae, and especially *Brachypodium ramosum*, should be eradicated, pioneer species such as *Quercus coccifera* and other deep-rooted shrubs can be usefully employed as natural 'nurses' in afforestation.

23.3 : 42.4 (45). Pepe, G. La foresta demaniale 'Duna Feniglia' e la tecnica del rimboschimento delle sabbie mobili. [**The 'Duna Feniglia' State forest and the technique of reforesting shifting sands.**] *Riv. for. ital.* 1, 1939 (15–26, 533–44). [It.]

23.3 : 23.22 : 11.46–7(489). Løfting, E. C. L. Jordbundsbehandlingens Indflydelse paa Rødgranens Vækst og Sundhed i Hedeplantagerne. [**The influence of soil treatment on the growth and health of Norway Spruce in heathland plantations.**] *Forstl. Forsøgsv. Danm.* 15, 1939 (165–89). [Da.e.]

In the preparation of heathland plantations, the burning of the heather is followed by a treatment of the soil lasting 4–6 years and consisting of ploughing, deep harrowing, re-ploughing, and trench ploughing with a tractor by means of which the humus layer, leached sand and the pan are broken up and mixed together. In smaller areas, and in places where there is danger of sand drifts, subsoil ploughing is substituted for trench ploughing, the pan being broken up but left in place.

Though trench ploughing, more than any other mechanical soil treatment, does produce a clean, loose soil in which nutritive substances are found in a comparatively easily accessible form, later operations, such as the planting of Spruce in mixture with Mountain Pine, and working the soil between plantation rows, may overshadow the effects of the original soil treatment, as is shown by experimental plots in the Dalgas plantation. Analysing the relative effect of original soil treatment only, it was determined that: (1) Other conditions being equal, trench ploughing in heathland results in a more rapid and uniform growth of Norway Spruce than do less intensive methods of cultivation, including subsoiling. The stagnant period during early growth is at least partly avoided. The start given by trench ploughing is the greater, the more unfavourable the conditions of the soil before treatment. (2) Height growth generally accommodates itself after the stagnant period to the quality of the site, irrespective of the original treatment. (3) Trench-ploughed plantations are attacked far more by *Polyporus annosus* than plantations in similar localities after less thorough treatment of the soil, and in consequence the latter often show a relatively better height growth before maturity is reached.

23.3 : 07 (729.4). Sylvain, P. Compte rendu préliminaire du travail forestier à la station de Kenscoff, Haïti. [**Preliminary report on forestry work at the Kenscoff Station, Haiti.**] *Carib. For.* 1, 1939 (16–22). [F.e.span.]

Several *Eucalyptus* species, *Pinus radiata*, and *P. occidentalis*, show promise as possible species for afforesting land subject to erosion in the cool mountainous region of Kenscoff.

23.3 (77.3–6). Wales, H. B. **Forest planting in the Lake States.** *J. For.* 37, 1939 (691–4).

23.3 : 23.24 : 12.2 (941). Stoate, T. N. **Pine establishment. An account of experiments in connection with the initial survival of Cluster Pine [*Pinus pinaster*] in Western Australian coastal plantations.** *Bull. For Dep. W. Aust.* No. 53. 1939. pp. 45.

It was found that the planting season should be restricted to the period late June to the end of July, that the ground should be prepared by ploughing followed by planting at the bottom of the cross furrows, and that subsequent cultivation around the planted Pine should be done before 15th October to eliminate competition by grass and herbs in the ensuing summer. Faults to be avoided are over short root-pruning, shallow setting of the Pine, and exposure of the roots, which is particularly dangerous in sunny weather.

23.3 : 38 : 42.3. Meginnis, H. G. **Soil-collecting trenches as substitutes for temporary check dams in reforesting gullies.** *J. For.* 37, 1939 (764–9).

Short trenches about 18 in. in depth and 18 in. wide were dug at right angles across drainage channels in compact subsoils of con-

solidated clay loam, the excavated material being piled down slope. While these subsoil materials are quite unproductive *in situ*, it was found that the soil outwash which filled the trenches was well suited for the growth of 1-year-old Loblolly Pine. Further investigations of this type of gully control are in progress.

23.4. *Formation of Forest by Natural Succession*

23.4 : 12.2 (75.5–7). McQuilkin, W. E. **Natural establishment of Pine in abandoned fields in the Piedmont region.** *Tech. Note Appalachian For. Exp. Sta.* No. 37. 1939. pp. 3.

Seed supply is the most important factor affecting density of stocking and this is controlled by (*a*) the quality of the seed trees and (*b*) the distance from seed source.

23.5. *Under-planting. Nurse Trees*

23.5 : 12.2. Rieben, E. Deux précieuses qualités du genévrier nain. **[Two valuable properties of the Dwarf Juniper.]** *J. for. suisse.* 90, 1939 (180–3). [F.]

The author recommends the use of Dwarf Juniper as 'nurse' for Spruce on dry and shallow soils in the Swiss mountains, and for the protection of anti-avalanche masonry walls from premature disintegration through atmospheric agencies.

23.5 : 23.24.2–3 : 12.2. **Beneficial effect of partial shade on field survival.** *Tech. Note Lake States For. Exp. Sta.* No. 144. 1939. p. 1.

Seedlings of *Pinus banksiana* and *P. resinosa* planted out under partial Aspen cover (light intensity 56 per cent.) showed a significantly higher survival than those planted in adjacent open ground. Since the main cause of mortality was drought, the better survival of plants under cover is attributed to a reduction of their transpiration rate.

23.7. *Slash Disposal. Clearing of Site*

23.7 : 43.1 : 44.3 (79). Childs, T. W. **Decay of slash on clear-cut areas in the Douglas Fir region.** *J. For.* 37, 1939 (955–9). [Bureau of Plant Industry, U.S.D.A.]

Examinations of logging debris on 135 representative slashings west of the Cascade Mountains in Oregon and Washington indicate that decay of logs is too slow to facilitate fire control materially during the period when rapid control is most likely to be necessary, and that decay causes a marked reduction in the inflammability of slash only after the perennial vegetation has shaded it sufficiently to prevent excessive drying. Although a few of the slash-inhabiting fungi are also able to attack living trees, the presence of old slash is not likely to cause any appreciable increase of disease in future stands. *Author's summary.*

23.7 : 32.2 : 07.7. Ehrhart, E. O. **An effective 'tree dozer'.** *J. For.* 37, 1939 (902–4). [Armstrong Forest Company.]

A suggested addition to the bulldozer equipment, for use in removing trees up to 18 in. in diameter from the right of way, is a 1 in. steel plate welded to the top of the bulldozer blade and projecting forward to lead the lower edge of the blade when the latter is raised to its maximum height. This plate will considerably increase the leverage possible with this equipment.

23.7 : 32.2 : 43.1. Kolbe, E. L. **Burning Ponderosa Pine snags by the base-fire method.** *J. For.* 37, 1939 (894–6). [Pacific Northwest Forest and Range Exp. Sta.]

The base-fire method, which consists in kindling a fire at the base of a snag near a cut chopped through the sapwood, is one method of removing dead trees and so improving control over accidental fires in the Ponderosa Pine region. The operation should be done in the fall, and snags with 50 per cent. or more of decay are the best type for burning. Snags that have been dead less than 4 years or that show less than one-fourth visible decay at the ground line are usually difficult to burn. High wind velocity and low humidity improve the success of the operation.

24. TENDING OF STANDS AND TREES

24 : 97.2 (73). Tillotson, C. R. **Care and improvement of the farm woods.** *Fmrs' Bull. U.S. Dep. Agric.* No. 1177. 1939. pp. 25.

24.2. *Thinnings*

24.2 : 24.5 : 12.2 (71.3). Sisam, J. W. B. **Thinning and pruning experiment, Red Pine plantation, Rockland, Ontario.** *Dom. For. Serv. Silvic. Res. Note* No. 57, 1939. pp. 35.

A detailed description of the present con-

dition of a 24-year-old Red Pine plantation established in the lower Ottawa valley (Ontario), and of experimental thinning and pruning operations undertaken in this stand. It is concluded that: (1) A relatively high yield of Red Pine can be obtained in this region, with a precipitation-evaporation index of 101·1, on sandy, well drained soils that are often submarginal for agriculture. The untreated per acre stand examined consisted of approximately 950 stems with a total volume of 3,700 cu. ft., an average diameter at b.h. of 6·1 in., and a maximum height growth of 42 ft. (2) Red Pine planted at a 6×6 ft. spacing under these site conditions will begin to show a reduced increment about 15 years after planting, and a spacing of 8×8 ft. might prove more efficient. (3) Pruning must be done carefully, preferably with a saw, and as close to the bole as possible. Careless axe pruning, leaving protruding branch stubs, is worse than useless. (4) Red Pine has a very slight susceptibility to attack by the White Pine weevil, and in fact is free from practically all insects and diseases when grown in Ontario and Quebec.

24.2 : 24.5 : 12.2 (79.5 : 79.7). KACHIN, T. **Crop tree thinning and pruning in Ponderosa Pine cutovers.** *For. Res. Notes Pacific Northwest For. Exp. Sta.* No. 27. 1939 (5).

In spot release thinning of 40 selected trees per acre it was found that a rigid 33-ft. crop-tree spacing requirement was detrimental to quality of tree selected and the effectiveness of the release. A flexible 16- to 50-ft. spacing is now in force. Based on a labour wage of 25 c. an hour, the cost of releasing and low pruning a tree is 5 c. whereas pruning to a height of 18 ft. costs 15 c. Thinning has doubled the growth rate of released trees in three years. It is estimated that pruning will increase the value of the product at least $1·00 per log.

24.2. KRAUCH, H. **First remeasurement of Gila stand improvement plots indicates uniform thinning of Ponderosa Pine pole stands not desirable.** *Res. Note Southwestern For. & Range Exp. Sta.* No. 62. 1939. pp. 5.

24.21. **Killing trees with sodium arsenite.** *Rubb. Res. Inst. Malaya Plant. Bull.* No. 5, 1939 (6–7).

A solution of 3 lb. of sodium arsenite in 1 gallon of water should be used, and about ½ pint of the solution should be applied to trees 18 in. in diameter, in a 'frill' cut in the bark around the tree.

24.21 : 44.1. BRUCE, H. D. **Chemical killing of sprouting stumps.** *Res. Note California For. & Range Exp. Sta.* No. 23. 1939. pp. 4.

Sodium chlorate has been found to be the most effective and reliable chemical for use in poisoning stumps to prevent sprouting. It is used in a 10 per cent. aqueous solution. There are four operations to be undertaken in stump poisoning: (1) all sprouts are chopped off at the crown, (2) all live portions of the stump are unearthed and exposed, (3) all live tissue is scarred by lightly hacking through the bark, (4) the poison solution is applied as a spray. A single treatment of this kind should result in the complete killing of 95 per cent. of the stumps, except for very large ones exceeding 25 in. in diameter. One gallon of solution should do 6 to 10 stumps.

24.21 : 44.3 : 01. LANTZ, A. E. **An efficient method for introducing liquid chemicals into living trees.** *E–434.* U.S. Dep. Agric. Bureau of Entomology & Plant Quarantine, Washington, D.C. 1938. pp. 4.

The method consists essentially of incising the circumference of the trees to a depth of 3 to 4 annual rings and of applying a piece of waterproof material (rubberized fabric or crepe-paper collar) to the incised portion in such a manner as to form a receptacle capable of holding liquids. The method is used to kill Elms infected by the Dutch Elm disease.

24.25 : 12.2. BADOUX, E. De l'influence de divers modes et degrés d'éclaircie dans les hêtraies pures. [**On the effect of various methods and grades of thinning on pure Beech woods.**] *Mitt. schweiz. Anst. forstl. Versuchsw.* 21, 1939 (59–146). [F.f.g.]

Results from permanent sample plot investigations in the cantons Aargau, Vaud, and Zurich, partly dating back as far as 1889. The total age range covered was from about 20 to 85, the quality classes ranging from II to IV (Flury's tables 1907). The four types of thinning studied were (1) B = light low thinning (*éclaircie par le bas*), where only dead and suppressed trees were removed; (2) C = medium low thinning, where dominated trees were removed as well; (3) D = heavy low thinning where, apart from dead, suppressed, or domin-

ated trees, some co-dominants and even dominants which appeared unproductive were felled; and (4) H = crown thinning (*éclaircie par le haut*), where the crowns of selected stems were freed from all harmful contacts, while dominated and suppressed trees were left as long as they were still alive.

The number of stems in plots which had received a C thinning was 57–86 per cent. of the stem number in comparable B plots, a percentage which either decreased or increased with age. The irregularity was still greater in D and in H plots. It was not possible to find any definite connexion between type of thinning on the one hand, and diameter increment, height increment, or periodic basal area increment of the stand on the other. The current basal area increment of single stems in a given diameter class was generally the greater, the more intensive the thinning, the greatest differences being observed for the mean diameter of the dominant and co-dominant portion of the stand. In some cases the volume increment of the stand was decreased through D and H thinnings as much as 20 per cent. as compared with B plots. D, H, and even C thinnings considerably decreased the growing stock in comparison with B thinnings. With regard to the quality of the stems produced ('good', 'medium', and 'poor' stems being distinguished by the Swiss Research Station according to length, straightness, and cleanliness of the bole), the dominant and co-dominant portion of the stand of H plots now contains 28–35 per cent. 'good' stems and only 9–18 per cent. 'poor' ones. In comparison, 29–51 per cent. of dominants and co-dominants in B plots are definitely 'poor'; the number of 'poor' stems is smaller in C and in D plots but it is still about twice as high as that in the crown-thinned plots.

It was not possible to correlate taper with type of thinning, but the tree-height/diameter-at-breast-height ratio for a given diameter class varied inversely with thinning intensity. Moreover, freeing appeared to lower this ratio the more, the poorer the site quality. On the average the relative crown height was 2–3 m. more in D and H plots as compared with B plots. The average crown height was generally the greater, the more intensive the thinning. The relative length of the sun crown, i.e. the length of the portion above the greatest crown width in relation to total crown length, of the dominants and co-dominants, was definitely greater in crown-thinned (H) plots as compared with low-thinned (B, C, and D) plots. The area shaded by the crown varied considerably for trees of the same diameter class according to thinning intensity, individual stem position, age, and site quality (20 cm. class, 12–25 sq. m.; 30 cm. class, 25–48 sq. m.; 40 cm. class, 42–59 sq. m.). On the other hand, the composition of the canopy appeared to be fairly constant for a given type of thinning, independent of age and of site quality. Crown asymmetry, as frequently observed on steep slopes, was markedly corrected as a result of proper H thinnings. After measuring crown profiles on a large number of felled trees and calculating crown from factors, it was possible to estimate the sum of crown volumes for each of the plots. This sum appeared to decrease as a stand grew older, independent of treatment. In 9 out of 11 plots a comparison between the basal area increment for the last 7–9 years and the present crown volume showed that the crowns of the co-dominant trees were relatively the most efficient. According to detailed crown maps prepared for each sample plot, the canopy was seriously opened (11–16 per cent. gaps) only in the case of C and D thinnings. The sum of the areas shaded by the crowns, even for dominants and co-dominants alone, was usually greater than the area of the plot. In the H plots, 36–69 per cent. of the soil would remain covered if all dominants and co-dominants were suddenly removed.

24.25 : 12.2. SCHANTZ-HANSEN, T. **Ten-year observations on the thinnings of fifteen-year-old Red Pine.** *J. For.* 37, 1939 (963–6).

The trees in the thinned plots show considerably better growth and less storm damage than those in the check (unthinned) plots.

24.25 : 56–7 : 33.32 : 12.2. MCCARTHY, E. F. **Planted Red Pine as related to pulpwood yields North and South.** *Paper Tr. J.* 109 (20), 1939 (36–8). [New York State College of Forestry, Syracuse, N.Y.] P.R.

If proper attention is paid to the thinning of *Pinus resinosa*, the present average volume increment of 100 cu. ft. per acre per year during the first 25 years can be doubled. In 6×6 ft. plantations overcrowding began at 17 years of age and severely reduced both height and diameter growth. Early thinnings of 5 cords per acre would show no immediate profit, but would benefit the remaining stand. At 25 years of age, the larger trees should be 40 ft. or more high and 10 in. in diameter. The best trees should be left for the final yield of saw timber

and should be pruned. The final yield will represent the bulk of the profits, but since all but the knot-free saw logs can be used for pulpwood, profits should also accrue from the later thinnings. Yields compare favourably with those of the Southern Pines, owing to the greater density of stocking and to the fact that, in the South, soil moisture is more seriously depleted by the longer growing season with higher temperatures.

24.3. *Opening of the Canopy. Release and Improvement Cuttings*

24.36 : 12.2 (77.8). LANE, R. D., and LIMING, F. G. **Some effects of release on planted Shortleaf Pine in the Missouri Ozarks.** *Sta. Note Central States For. Exp. Sta.* No. 37. 1939. pp. 6.

1–0 Shortleaf Pine seedlings released in the year of planting, by cutting, notch-girdling, and peel-girdling of the overstorey trees, responded with a growth rate varying inversely with the density of the stand and a mortality increase of 60 per cent. Release of 1–0 seedlings after one growing season in the field resulted in even higher mortality and a relatively lower increase in height increment.

24.36 : 12.2. LEXEN, B. **Growth following partial cutting in Ponderosa Pine.** *J. For.* 37, 1939 (943–6).

A re-analysis of growth data obtained from an experiment established in 1913 to determine the effect of shelterwood, group selection, and scattered seed tree cutting methods on the development of the residual stands.

24.36 : 56. KRAUCH, H. **The influence of release in relation to diameter growth of Ponderosa Pine.** *Res. Note Southwestern For. & Range Exp. Sta.* No. 59. 1939. pp. 2.

Measurements of healthy released trees of all crown classes and of healthy open-grown trees with large crowns indicate that the diameter growth of the former tends to be greater. In marking stands for cutting it is important that trees reserved for future growth be released rather than that they should conform to a specified tree classification.

24.4. *Shelterbelts. Windbreaks*

24.4 (77.6). HANSEN, H. L., and SCHMITZ, H. **A resurvey of the demonstration prairie shelterbelts in Minnesota.** *Bull. Univ. Minn. agric. Exp. Sta.* No. 337. 1938. pp. 16.

Extreme climatic conditions and diversity of soil types characterize this region, and available soil moisture is usually a limiting factor for successful tree growth. A total of 25 species were planted, and 13–15 years after establishment the survival varied greatly with species, the four showing highest survival being Green Ash and Box Elder 70 per cent., American Elm 52 per cent., and Caragana 45 per cent. Green Ash was found to be the tree best suited for planting in this region. Live-stock grazing and lack of cultivation and care were the main causes of the poor condition of many of the shelterbelts.

24.4 : 42 (78.3). GEORGE, E. J. **Farm windbreak—handling trees to withstand drought conditions.** *Bi-m. Bull. N. Dakota agric. Exp. Sta.* 1 (5), 1939 (11–14).

The planting site should be of light soil, prepared by clean summer fallow or at least one cultivated crop. Planting stock should be proven drought resistant. The planting should be planned and carried out with care. Windbreak plantings should be cultivated until the cover closes and snow drift should be kept within the plantation as much as possible. Roughening the soil in the fall, building dams, ploughing furrows along slopes, and diverting run-off water to the plantation are other methods for improving soil moisture conditions.

24.4 : 23.21 : 09.7 (78.3 : 78.6). GEORGE, E. J. **Tree planting on the drier sections of the Northern Great Plains.** *J. For.* 37, 1939 (695–8).

Annual precipitation in the region averages 15 in. or less, and the soils are mainly of the chestnut earth group. Twenty-five years' experience has shown that shelterbelts can be established successfully on most sites. Conifers are used as a rule and attain heights up to 25 ft., which is considered satisfactory.

24.5. *Pruning*

24.5 : 12.2 (41.1–4). BEACH, J. E. G. **The pruning of Scots Pine and Sitka Spruce.** *Scot. For. J.* 53, 1939 (85–9).

It is concluded that pruning should be done as early as possible after the plantation reaches the pole stage, that pruning higher than 30 ft. is not likely to prove economical, that the best tools for pruning are pole saws up to 12–15 ft.

and above that light ladders and hand saws, and that to be a successful business undertaking pruning should not cost more than 3*d*. per tree.

24.5 : 12.2 (79.5 : 79.7). WELCH, D. C. **Pruning of selected crop trees in Douglas Fir.** *For. Res., Notes Pacific Northwest For. Exp. Sta.* No. 27, 1939 (4).

It was determined that branch diameter and the number of branches in the first 18 ft. increases with tree diameter, both being greatest on dominant trees, which tend to have a higher percentage of live branches than the co-dominants. The total time required by a three-man crew to prune a tree up to the 18-ft. level, using hand saws and pole saws, varied from a minimum of 4·08 min. for a co-dominant to a maximum of 7·59 min. for a dominant.

24.5 (931). WILLIAMSON, P. **Pruning of timber plantations in New Zealand.** *Emp. For. J.* 18, 1939 (253–8).

It is suggested, particularly as regards *Pinus radiata*, that at the age of 7–8 years all trees except those on the edge of the stand should be pruned to a height of 6 ft., mainly to improve visibility and movement for the selection of crop trees, and to reduce fire risk. This is followed by a second pruning of 250–300 trees per acre up to 15–20 ft. and possibly further pruning of final crop trees (150–200 trees per acre).

As a result of an investigation into pruning methods and tools, the author favours a special type of secateurs for low pruning and a 'lance chisel' for high pruning. Both of these are described. The latter is made from an old slasher blade, cut diagonally about half-way down, sharpened like a chisel, and fastened to the end of a long pole. The sharpened edge is applied to the underside of the branch to be removed, while the lower end of the lance is tapped with a maul.

24.5 : 34.24 : 12.2. NATIVIDADE, J. V. Técnica cultural dos sobreirais. I. Poda. [**Technique of tending Cork Oaks. I. Pruning.**] Junta Nacional da Cortiça, Lisbon, Portugal. 1937. pp. 53. [Por.]

24.5 : 34.24 : 12.2. NATIVIDADE, J. V. Técnica cultural dos sobreirais. II. Descortiçamento. [**Technique of tending Cork Oaks. II. Barking.**] Junta Nacional da Cortiça, Lisbon, Portugal. 1938. pp. 71. [Por.]

24.5 : 56. WADSWORTH, F. H. **Effect of high pruning on the diameter growth and taper of Ponderosa Pine.** *Res. Note Southwestern For. & Range Exp. Sta.* No. 42. 1938. pp. 3.

Diameter measurements of 8 pruned and 8 unpruned trees over periods of 15 years before and 15 years after pruning indicate that pruning, which removes all branches up to a height of 34 ft., or about one-third of the living crown, reduces growth throughout the bole over a long period of time. Growth reduction is greatest at the base of the tree, thus decreasing the taper.

3. FOREST UTILIZATION. FOREST TECHNOLOGY

3 : 12.2 (73). BETTS, H. S. **American Woods.** U.S.D.A., Forest Service, Washington, D.C. 1936–9.

Thirty-five pamphlets as part of a series, each presenting, briefly, data on nomenclature, distribution and growth, supply, production, properties, and principal uses of a forest tree species found in the United States.

3 : 12.2 (73). U.S.A. **American Woods.** U.S.D.A., Forest Service, Washington, D.C. 1931–6.

Eight pamphlets as part of a series, each presenting, briefly, data on distribution and growth, supply, production, properties, and principal uses of a forest tree species found in the United States.

3 : 07 (73). WINSLOW, C. P. **Trends and needs in modern wood utilization.** *J. For.* 37, 1939 (674–6).

The author stresses the necessity for an adequate programme of utilization research, extension, and education. American records indicate that successful industries spend 1 to 2 per cent. of the sale value of their product upon research. The U.S. Government owns almost one-third of the nation's forest lands, but the public research programme on utilization aggregates only about one forty-eighth of the annual sale value of American forest products. The aim of the research programme should be to diminish the very considerable losses of material in the woods, in conversion and in manufacturing plants, and to improve the present products

and develop new ones in order to offer better service to the consumer and to check the decline of the *per capita* consumption of timber. The research programme should also include a long-range study of the influence of transportation costs on the economics of distribution and, indirectly, on the growing of forest crops. With regard to extension and education, the provision of at least one utilization extension officer for each of the states appears justifiable.

3 : 98 (79.4). Berry, J. R. **Notes on the lumber industry in California.** *For. Notes Coll. Agric. Calif.* 1939 (3–6).

3 (81). **Forest products of North Brazil.** Serviço Florestal, Brazil. 1939. pp. 34. Univ. Calif. Coll. Agric. For. Dep. Libr. Acc. 5, 4 (1).

3 : 09.4. Ainslie, J. R. **Softwood substitutes in war-time.** *Wood* 4, 1939 (436–40).

With reference to sources within the Empire, particularly Canada, Newfoundland, West Africa, and British Honduras, these places being relatively accessible.

3 : 12.2. *Cedarnotes* Nos. 1–78. 1928–39. Research Division, Western Red and Northern White Cedar Assn., Metropolitan Bank Bldg., Minneapolis.

Short semi-popular notes on the wood properties and utilization of *Thuja plicata*, Western Red Cedar. A good index is provided.

3 : 12.2. Lamb, G. N. **The Mahogany book.** Mahogany Association, Inc., 75 East Wacker Drive, Chicago. 1939. pp. 64.

31. PROPERTIES AND ANATOMY OF WOOD

31 (87). Williams, L. Maderas económicas de Venezuela. [**Commercial woods of Venezuela.**] *Bol. técn. Minist. Agric. y Cria* No. 2. Cooperativa de Artes Gráficas, Caracas. 1939. pp. 97. [Span.]

More than 60 Venezuelan trees are dealt with in this bulletin, the bulk of which consists of descriptions of the trees and their woods, together with notes on their distribution, vernacular names, and uses. Two valuable tables are provided; in one of these the woods are classified according to their approximate weight (light, medium, heavy), in the other they are listed according to their uses, such as carpentry, cabinet-making, furniture, exterior and interior work, and special purposes. A glossary of the special terms employed and an index to scientific and vernacular names are also included.

31 : 01. **List of publications on the growth, structure, and identification of wood.** Forest Products Laboratory, Madison, Wisconsin. 1939. pp. 34.

31 (81). Brotero, F. A. Métodos de ensaios adotados no I.P.T. para o estudo das madeiras nacionais. [**Testing methods used in the I.P.T. for the study of home-grown woods.**] *Bol. Inst. Pesq. tecnol. de S. Paulo* No. 24. 1939. pp. 28. [Por.]

31.1. *Form. Size. Structure. Anatomy. Identification*

31. 1–2 : 12.2 (45). Cormio, R. Il legno di olmo campestre e di olmo siberiano dal punto di vista anatomico e meccanico. [**The wood of *Ulmus 'campestris' & U. pumila* from the point of view of anatomy and mechanical properties.**] *La Montagna Italiana* 1938? pp. 24. [It.] [Civica Siloteca Cormio, Milan.]

U. pumila, which is being acclimatized in Italy, though immune to *Graphium ulmi*, is considerably inferior to the indigenous *U. campestris* in regard to mechanical properties, and is also inferior to the *U. pumila* growing in the countries of its origin in Asia. It is pointed out, however, that the only specimens of *U. pumila* available for the tests were from 5-year-old trees.

31.1–2 : 12.2 (67.7). Cormio, R. Legnami dell' Impero. L'*Avicennia marina* dell' Oltre Giuba, sue caratteristiche anatomiche e meccaniche e sue applicazioni. [**Woods of the Italian Empire. *Avicennia marina*, from Italian Jubaland : anatomical characters, mechanical properties, and uses.**] *Lignum* Nos. 5–6. 1939. pp. 11. [It.] [Civica Siloteca Cormio, Milan.]

31.1 (7–8). Record, S. J. **American woods of the family Anacardiaceae.** *Trop. Woods* 60, 1939 (11–45).

The wood anatomy of 65 genera and 500 species is described and notes given on their distribution and chief botanical characters. The descriptions are by genera, as in the preceding papers in this series.

31.1 : 12.2 (91.4). Aguilar, L. **Fiber length of Philippine coniferous woods.** *Philipp. J. For.* 2, 1939 (277–86). [Division of Forest

Studies and Research Bureau of Forestry, Philippines.]

The species *Agathis alba*, *Phyllocladus hypophyllus*, *Dacrydium falciforme*, and *Podocarpus blumei*, whose fibres are 6·379±0·029, 2·650±0·044, 3·625±0·0206, and 4·252±0·0397 mm. long respectively, might be used in the manufacture of aeroplane parts. They compare favourably with Sitka Spruce which has an average fibre length of 5·60 mm. Although the species *Dacrydium elatum*, *Pinus insularis*, and *P. merkusii* have long tracheids, their lengths show considerable variation.

31.1 : 11.14. Schumacher, F. X., and Day, B. B. **The influence of precipitation upon the width of annual rings of certain timber trees.** *Ecol. Monogr.* 9, 1939 (389–429). [Forest Service, U.S.D.A.]

The material included 2 groups of White Oak from western North Carolina, 3 groups of Longleaf Pine from Florida, 2 groups of Shortleaf Pine from northern Virginia, and a group of Hemlock from New Hampshire. One group of Longleaf Pine, one of Shortleaf Pine, and the Hemlock were not affected to any significant extent by either the average monthly precipitation or its distribution over the 15-month period. Two groups of Longleaf Pine and one of Shortleaf Pine were found to be dependent on amount of precipitation, but not to any significant extent upon its distribution, for added width of annual ring. The Oak appeared to be sensitive to both amount of precipitation and its distribution. *From authors' summary.*

31.1 : 12.11. Trendelenburg, R. Über die Entstehung und das Wachstum des Holzes, sowie seine Veränderungen im Lauf des Baumlebens und nach der Fällung. [**On the origin and growth of wood, and on changes in wood during the life of the tree and after felling.**] *Mitt. Fachaussch. Holzfr.* 23, 1939. pp. 9. [G.] Repr.

31.1 : 12.11 : 12.2. Heimsch, C., and Wetmore, R. H. **The significance of wood anatomy in the taxonomy of the Juglandaceae.** *Amer. J. Bot.* 26, 1939 (651–60). [Biological Laboratories, Harvard University, Cambridge, Mass.] O.B.D.

According to wood anatomy, the genera of Juglandaceae may be arranged in ascending order of specialization as follows: *Alfaroa*, *Engelhardtia*, *Pterocarya*, *Juglans*, *Carya*. The isolated genus *Platycarya* seems to have achieved considerable specialization along independent lines. These results offer strong confirmation of Manning's interpretation of generic relationships within the family, based on a study of inflorescences. *Platycarya* is the only genus where the anatomical and morphological evidence differ, as Manning finds its inflorescence generalized for the family and consequently regards it as primitive.

31.1 : 12.14. Chattaway, M. M. **Crystalliferous strands.** *Rodriguesia* 4 (12), 1939 (55–8).

Milanez, F. R. **On crystalliferous strands. II.** *Rodriguesia* 4 (12), 1939 (59–65).

Chattaway, discussing intermediate crystalliferous tissue in the Sterculiaceae, admits the contention of Milanez that these cells are not fibres as they are subdivided by walls and not septa, but maintains that they are not parenchyma either since they are almost as long as typical fibres and 3–4 times the average length of the parenchyma strands. She suggests that they should be recognized as intermediate and called 'fibre-like' or 'parenchyma-like' cells according to their chief characteristics. Milanez objects to their being distinguished from parenchyma on a single character—elongation—and contends that there may occasionally be elongated parenchyma strands just as there are sometimes short fibres. He suggests that the particular elements in question are compound, being part fibre and part parenchyma.

31.1 : 12.2. Fasolo, U. Sul possibile valore sistematico del minimo lume vasale nei legni di Angiospermae. [**Possible taxonomic value of minimal vessel size in Angiosperms.**] *Nuovo G. bot. ital.* 45, 1938 [1939] (196–201). [It.] Biol. Abs. 13 (13783).

31.1 : 12.2. Misra, P. **Observations on spiral grain in the wood of *Pinus longifolia* Roxb.** *Forestry* 13, 1939 (118–33). [Botany Department, University of Leeds.]

Rate of radial growth, inclination of the spiral grain to the vertical, micellar pitch on the tracheide wall in relation to its own axis, and tracheide length were studied in different octants of each year's growth, in four pieces of stem, each from a different plant of Chir Pine (*Pinus longifolia*) with pronounced twisted fibre. The following correlations were observed in all of them: (*a*) Excentricity in radial growth and the inclination of twisted fibres appear to be correlated with each other. In an annual ring octants

having more radial depth possess less inclined tracheides than octants having less radial depth. A subsequent change in the rate of radial growth in excentric rings is linked with an inverse rate of change in the inclination of the tracheides. (*b*) Excentricity in radial growth shows correlation with the micellar pitch on the tracheide walls just as in the horizontal branches of other conifers. The steepness of micellar pitch is greater on a side where there is less radial growth. The rate of change in micellar pitch, from ring to ring, appears to vary inversely with the rate of change of radial depth. (*c*) The length of tracheides also is correlated with the excentricity of radial growth just as in the case of horizontal branches of other conifers. Smaller tracheides are found in octants having greater radial depth, and longer tracheides are found in octants having less radial depth. A subsequent change in the rate of radial growth in excentric rings is linked with an inverse rate of change in the length of tracheides. *From author's summary.*

31.1 : 31.21 : 07.7. JAYME, G., and HEININGER, R. Neue Verfahren zur Bestimmung von Gefügeunterschieden in Hölzern. I. Beschreibung einer neuen Messmethodik. [**New process for determining differences in the texture of woods. I. Description of a new method of measurement.**] *Holz* 2, 1939 (377–83). [G.] [Institut für Zellulosechemie der Technischen Hochschule Darmstadt.]

Two new instruments, constructed by the authors, are described: (1) for the determination of the volume of solid bodies, such as wood, on the basis of displacement of a suitable liquid, and (2) for determining the pore structure of wood and other solid bodies by measuring the volume of gas (air) they give off under a given vacuum.

31.1 : 31.25 : 12.2. STRYŁA, S. Zależność między procentową zawartością drewna późnego, a twardością sosny pospolitej. [**Research on the relation between the percentage of summerwood and hardness of wood in *Pinus sylvestris*.**] *Roczn. Nauk rol.* 44, 1938 (361–74). [Pol.f.]

The coefficient of correlation between the percentage of summerwood and the hardness as determined by Brinell's method was +0·58 for all (675) specimens; +0·68 for (220) sapwood specimens; +0·73 for (226) specimens from the border region between sapwood and heartwood; and +0·73 for (229) heartwood specimens.

31.1 : 33.32. GRAFF, J. H., and MILLER, R. W. **Fiber dimensions.** *Paper Tr. J.* 109 (6), 1939 (31–7). P.R.

The history of the different methods of fibre mensuration is outlined. A standardized method for the microscopic determination of fibre dimensions is presented and discussed with regard to probable errors, time requirement, the evaluation of results, and its application to the fibres of kraft pulp from various localities and tree species.

31.1 : 33.32. PEW, J. C., and KNECHTGES, R. G. **Cross-sectional dimensions of fibers in relation to paper-making properties of Loblolly Pine.** *Paper Tr. J.* 109 (15), 1939 (46–8). P.R.

Fibre measurements in transverse sections of second-growth Loblolly Pine of both rapid and slow growth rates and containing high, medium, and low volumes of springwood indicate: Wood of slow growth, on the average, has thicker-walled summerwood cells than that of fast growth, but the springwood cells average about the same wall thickness for both types of wood: neither the springwood nor the summerwood fibres vary widely in cross-sectional dimensions with the height in the same tree: and both the springwood and summerwood fibres in trees of the same growth-rate class may vary considerably from tree to tree in the average cross-sectional dimensions at points of equivalent springwood content. It appears that the classification of wood, according to growth rate and springwood-summerwood ratio only, is not sufficient to characterize completely the material for pulping purposes, but that the relationship of the springwood-summerwood ratio to specific gravity must also be considered. *From authors' summary.*

31.2. *Physical Properties*

31.2 RAFALSKI, J. **Certain physical and mechanical properties of some Peruvian woods.** *Roczn. Nauk rol.* 46, 1939 (219–28). [Pol.e.] [Institute of Forest Engineering, University of Poznań.] C.G.B.

Laboratory tests of air-dry samples measuring 2·0 × 2·0 × 2·5 cm. The woods were supplied to the Institute with vernacular names only and with no supporting botanical material. They were: Canelon, Aceituna, Yanay, Zarpa, Copal,

Pucapuca, Puca nahui, Paucho, Nazareno, Huillca (*Piptadenia rigida* Bth.?), Chuchu-Huasa, Balsamo (*a*) (*Myroxylon toluiferum* H.B.K.?), Taruca-asta, Ppaspa-ccara, Nogal amarillo (*Juglans peruviana* Dode?), Balsamo (*b*), Payacq cuncan, Chinsi-unca, Sumbayllo, and Huaranhuay (*Acacia macracantha* H. and B.?).

A table gives the moisture content, specific gravity (air-dry, and oven-dry based on volume when air-dry), compression strength parallel to the grain, Brinell hardness, and static value for each of the woods tested. The values tabulated are averages for three test-pieces.

31.2. Rafalski, J., and Stryła, S. **Research on the wood of *Araucaria brasiliana* Lamb. and *Aspidosperma polyneuron* Müll. Arg., two Brazilian trees of great economic importance.** *Roczn. Nauk rol.* 46, 1939 (229–64). [Pol.f.] [Institute of Forest Engineering, University of Poznań.] C.G.B.

Tests on the physical and mechanical properties of 'Parana Pine' (*Araucaria brasiliana*) and 'Peroba Rosa' (*Aspidosperma polyneuron*). The mechanical properties of these two woods resemble those of tropical rather than temperate woods. *From authors' summary.*

31.22. Bateman, E., Hohf, J. P., and Stamm, A. J. **Unidirectional drying of wood.** *Industr. Engng. Chem.* [Industr. Ed.] 31, 1939 (1150–4). [Forest Products Laboratory, Madison, Wis.] P.R.

Measurements were made of the rate of drying from a single face of small cylinders of Sitka Spruce at different temperatures and under different relative humidity and atmospheric pressure conditions. Moisture gradients were determined on the specimens prior to the complete removal of free water. Drying in all cases gave weight losses that varied directly with the square root of time. Values for the mean effective diffusion per unit moisture gradient were calculated from the rate of drying and the moisture gradients up to the fibre saturation point. The values increase slightly with an increase in the relative humidity effective in the drying, and increase to a greater extent with an increase in the drying temperature, a decrease in the atmospheric pressure, and a decrease in the specific gravity of the wood. *Authors' summary.*

31.22 : 07.7. Dunlap, M. E. **Electrical moisture meters for wood.** Forest Products Laboratory, Madison, Wisconsin. 1939. pp. 5.

31.22 : 33.36. Falck, R. **Treatment of timber.** Austrian Pat. 156, –284. 1939. [Cl. 38*d*.] Chem. Abs. 33 [7988]. P.R.

Swelling of timber is reduced by treatment with a gaseous or dissolved halogen. The amount of halogen must be determined experimentally, but must be such that the wood is not injured. A halogen-carrier may be incorporated in the timber or in the halogen solution. Various methods are specified.

31.22 : 33.6. Jenkins, J. H., and Guernsey, F. W. **The relation of the moisture content of wooden boxes to the rusting of cans.** *B.C. Lumberm.* 23 (8), 1939 (21–2).

Medium and heavy rusting occurred in cans stored in wooden cases having a moisture content in excess of 17 per cent. Results indicate that if properly seasoned lumber dried to a moisture content not exceeding 16 per cent. is used in the manufacture of wooden cases, there is no danger of damaging rust occurring on canned goods as a result of moisture in the wood. *From authors' summary.*

31.22–3 : 12.2. Stryła, S. Badanie nad wskaźnikiem zupełnej skurczliwości objętościowej drewna sosny pospolitej. [**Research on the ratio of total volumetric shrinkage to specific gravity at O per cent. moisture in the wood of *Pinus sylvestris*.**] *Roczn. Nauk rol.* 41, 1937 (230–45). [Pol.f.]

The ratio can be expressed by

$$R = \frac{Sk}{Do} = \frac{Vm - Vo}{Vo} \times 100 : \frac{Po}{Vo} = \frac{Vm - Vo}{Po} \times 100,$$

where *Sk* is the total volume shrinkage, *Do* the specific gravity at O per cent. moisture content, *Vm* the volume of the specimen when saturated with water, *Vo* the volume when completely dry, and *Po* the weight of the specimen when completely dry. The 324 specimens (2×2×2 cm.) tested were from different parts of trees belonging to various kraft-classes. *R*, *Sk*, and *Do* varied considerably. The averages were $R = 33{\cdot}80 \pm 0{\cdot}31$, $Sk = 17{\cdot}04$ per cent. $\pm 0{\cdot}146$, and $Do = 0{\cdot}506 \pm 0{\cdot}00448$.

31.22–3 : 12.2. Vintila, E. Untersuchungen über Raumgewicht und Schwindmass von

Früh- und Spätholz bei Nadelhölzern. [**Research on specific gravity and shrinkage of springwood and summerwood in conifers.**] *Holz* 2, 1939 (345–57). [G.g.]

The tests were carried out on a large number of samples from Pine, Larch, Douglas Fir, and Silver Fir. The tangential and volume shrinkage of summerwood was, in absolute figures, much greater than that of springwood, but it was smaller per unit weight. Longitudinal shrinkage was greater in springwood, and it decreased in both springwood and summerwood with increasing density. Radial shrinkage was about as great as tangential shrinkage in summerwood and 2 to 3 times smaller than tangential shrinkage in springwood. Comparative tests on undivided samples and on separate constituents from corresponding pieces showed that the tangential shrinkage of whole samples is somewhat smaller than that of summerwood but greater than that of springwood—hence tension in summerwood and compression in springwood. In radial direction, however, springwood need not shrink more than is determined by its own structure. Since springwood constitutes 60 to 80 per cent. of the total, and since, furthermore, the radial shrinkage of springwood is particularly small, it results that conifer wood must shrink much less radially than tangentially.

31.25 : 12.2 (54). LIMAYE, V. D. **Timber testing in India: *Anogeissus pendula* [Kardhai] breaks world record in toughness tests.** *Indian For.* 65, 1939 (628–9). [Forest Research Institute, Dehra Dun.]

Anogeissus pendula (Kardhai) from the United Provinces is found to be the toughest timber so far tested at the Forest Research Institute, Dehra Dun, and, as far as is known, it has withstood a greater blow from a 50 lb. hammer than any other timber so far tested in any other laboratory in the world. It is a small tree and there is a considerable yearly output. The timber is at present used for firewood and charcoal. *From author's summary.*

31.27. RAFALSKI, J., and WARDYN, A. **Research on the structural properties of wood: Influence of longitudinal perforation of wood on its resistance to longitudinal compression.** *Roczn. Nauk rol.* 46, 1939 (202–18). [Pol.f.] [Institute of Forest Engineering, University of Poznań.] C.G.B.

Tests of the resistance to longitudinal compression of 384 samples of Birch (*Betula alba* L.) wood, of which 64 were left intact and 320 perforated longitudinally, the number, diameter, and spacing of the holes being varied in different samples. Corrected to 15 per cent. moisture content, the results show that, in contrast to the behaviour of metals under similar conditions, the compressive strength of a wooden block perforated longitudinally is less than that of an intact block of the same dimensions minus the volume of the perforations, i.e. the resistance to compression stated in kg./cm.^{2} is greater in intact than in perforated wood. *From authors' summary.*

31.27 : 07.7. STEVENS, W. C. **Bending thin wood: an apparatus and method for estimating the percentage of breakages likely to occur when bending thin wood specimens to various radii of curvature.** *Wood* 4, 1939 (425).

31.27 : 31.22. ERICKSON, H. D. **The relation of maximum crushing strength of wood to the degree of swelling induced by various chemicals.** *Science* 89, 1939 (38–9). [University of Minnesota.]

Small blocks of the sapwood of Norway Pine (*Pinus resinosa*) were oven-dried and placed in various organic liquids, mostly alcohols. The measurement of saturated blocks showed an inverse correlation of crushing strength with swelling, although the organic liquids did not weaken the wood to the same extent as water for a given degree of swelling. Measurements of other blocks, in which moisture content had been raised above fibre saturation point and various aqueous solutions had been injected, showed that both strength and swelling increased with chloride salts, that thiocyanate, iodide salts, resorcinol, pyrogallol and urea solutions caused swelling but decreased strength, and that chloral hydrate caused greater swelling and increased crushing strength by about 40 per cent.

31.27 : 38. SCHOLTEN, J. A. **Strength of bolted timber joints.** Forest Products Laboratory, Madison, Wisconsin. 1939. pp. 3.

A table is included which gives the safe loads, in pounds per bolt, for common bolts of different sizes used with both hardwoods and softwoods of various species groups, and sizes, that have been seasoned for use in a dry location. A summary is given of the details of design required in applying the values shown in this table.

31.3. *Chemical Properties*

31.3. HARRIS, E. E., and ADKINS, H. **Reactions of lignin with hydrogen.** Forest Products Laboratory, Madison, Wisconsin. 1938. pp. 7.

Lignin isolated by methanol and hydrochloric acid, alkali lignin and sulphuric acid lignin have been subjected to temperatures of 250 to 260° C. in the presence of hydrogen at 170 to 400 atmospheres. Four products have been separated and identified: methanol; 4-*n*-propylcyclohexanol-1; 4-*n*-propylcyclohexanediol-1, 2; and 3-(4-hydroxycyclohexyl)-propanol-1. The properties of the high boiling residue show that there are units in lignin containing 18 or more carbon atoms. *Authors' summary.*

31.3. KÜRSCHNER, K., and WITTENBERGER, K. Beiträge zu einem einfachen Verfahren der Ligninbestimmung. [**Contributions to a simple method of lignin determination.**] (Concld.) *Papierfabrikant* 37, 1939 (311–15). [G.] P.R.

31.3 : 01. **List of publications on chemistry of wood and derived products.** Forest Products Laboratory, Madison, Wisconsin. 1939. pp. 33.

31.3 : 12.14. HARLOW, W. M. **Contributions to the chemistry of the plant cell wall. IX. Further studies on the location of lignin, cellulose, and other components in woody cell walls.** *Paper Tr. J.* 109 (18), 1939 (38–42). [New York State College of Forestry, Syracuse, N.Y.] P.R.

31.3 : 12.2. WIECHERT, K. Darstellung und Eigenschaften des Rotbuchenlignins. [**Preparation and properties of Common Beech lignin.**] *Papierfabrikant* 37, 1939 (325–32, 339–43). [G.g.] P.R.

The lignin was completely isolated by a new method using anhydrous hydrogen fluoride at −65° C. after the bulk of the accessory constituents had been removed by extraction with a mixture of benzene and alcohol and by boiling in distilled water. Carbohydrates did not form brown, insoluble products in the course of the HF-extraction. Formalin and vanillin were freed, but not acetic acid. There was no evidence of the presence in larger amounts of lignin constituents of low molecular structure. The lignin contained 1·7 per cent. dioxymethylene, which is considered typical for Beech.

31.3 : 31.1. COPPICK, S., and FOWLER, W. F. **The location of potential reducing substances in woody tissues.** *Paper Tr. J.* 109 (11), 1939 (81–6). [New York State College of Forestry, Syracuse, N.Y.] P.R.

A method is described for staining woody tissue which clearly differentiates between the more lignified and lesser or unlignified portions of the cell walls. The reaction involved is a modification of the well known Tollen's or silver nitrate oxidation of reducing substances, wherein the ammonia is replaced by a 3 per cent. solution of ethanolamine in 95 per cent. ethyl alcohol, which facilitates reaction at room temperature. Treatment of wood with chlorine water liberates or generates reducing substances which precipitate silver from the reagent in the cell wall. The location of the precipitated silver in the cell wall, when compared with studies on the action of various lignin and cellulose indicators and solvents and with polarized light studies, indicates that the reactant is associated with or is a part of the lignin complex, quite likely the lignin-hemicellulose complex. *From authors' summary.*

31.3 : 33.0 : 33.32. BRAY, M. W. **Methods used at the Forest Products Laboratory for the chemical analysis of pulps and pulpwoods.** Forest Products Laboratory, Madison, Wisconsin. Revised ed., 1939. pp 41.

31.4. *Durability. Decomposition*

31.41. Natural Durability

31.41 : 12.2 (91.4). LAGRIMAS, M. **Relative durability of untreated Redwood** [*Sequoia sempervirens.*] *Philipp. J. For.* 2, 1939 (259–65). [Division of Forest Studies and Research Bureau of Forestry, Philippines.]

Twenty pieces of Redwood free from sapwood, each 1 in.×4 in.×12 in., were tested in a 'graveyard' for a period of nearly 3 years. The testing ground was a clay loam, shaded and moist, and heavily infested with termites. A wide range of durability resulted and the average duration of the pieces was 656 days. It is concluded that this species should not be used in contact with the ground under these conditions unless it has been treated with preservatives.

31.42. Attack by Plant Organisms

31.42 : 33.32 (485). RENNERFELT, E. Utveckling av svampar i slipmassa av färsk och flottad

ved. **[The development of fungi in mechanical pulp of fresh and floated wood.]** *Svensk Papp Tidn.* 42, 1939 (2–5). [Sw.] R.A.M. 18 (774).

The development of the yeasts *Rhodotorula glutinis* and *Saccharomyces cerevisiae*, and of the bluing fungi *Cadophora* (*Phialophora*) *fastigiata* and *Pullularia pullulans*, was much more rapid on green than on floated wood of Spruce and Pine. Cultures of the fungi on glucose with the addition of green wood or a green-wood extract also grew far more quickly than cultures on pure glucose. The increasingly common practice in Sweden of mixing fresh with floated wood should therefore be discouraged, especially when the pulp cannot be dealt with at once.

31.42 : 12.2 (76). VERRALL, A. F. **Relative importance and seasonal prevalence of wood-staining fungi in the Southern States.** *Phytopathology* 29, 1939 (1031–51). [Bureau of Plant Industry, U.S.D.A.]

Isolations and artificial inoculations showed that the major stain damage in lumber and logs in the Southern States is caused by 7 fungi: *Endoconidiophora coerulescens*, *Ceratostomella pluriannulata*, *Diplodia natalensis*, and *Graphium rigidum* in hardwood; and *Ceratostomella pilifera*, *C. ips*, *Diplodia natalensis*, and *Diplodia* sp. in Pines. There is a general correlation between the seasonal frequency of staining fungi and the temperature relations for their growth. *From author's summary.*

31.42 : 12.12 : 12.2. BOSE, S. R. **Enzymes of wood-rotting fungi.** *Ergebn. Enzymforsch.* 8, 1939 (267–76). R.A.M. 18 (829).

A review of outstanding work on the subject.

31.42 : 12.2. KASAI, M. **The staining fungus *Graphium rubrum* Rumbold, on Chinese bandoline wood.** *Ann. phytopath. Soc. Japan.* 8, 1939 (327–30). [Jap.] R.A.M. 18 (828–9).

Morphological and cultural characters of *Graphium rubrum*, the agent of a greyish staining in the wood of *Machilus thunbergii*.

31.42 : 31.22 : 11.14. FREYFELD, E. E. **The effect of humidity on the growth of wood-destroying fungi in timber.** *Sovetsk. Bot.* 1939 (99–103). R.A.M. 18 (644).

From laboratory experiments it is concluded that the minimum water content for the growth of the mycelium of *Poria vaporaria* in infected timber is 26 per cent. and that sound timber can be infected by this fungus when its water content is not lower than 28 per cent. at a relative humidity of 96 per cent.

31.42 : 31.27 : 12.2. FINDLAY, W. P. K., and PETTIFOR, C. B. **The effect of sap-stain on the properties of timber. III. Effect of sap-stain on the modulus of elasticity of Scots Pine sapwood.** *Forestry* 13, 1939 (146–7). [Forest Products Research Laboratory, Princes Risborough, Bucks.]

As results given in a previous article [*Forestry* 11, 1937 (40–52)] were unsatisfactory, further tests have been made using the same specimens before and after staining, thus eliminating variations between stained specimen and control. It was determined that slight staining caused no significant decrease in the modulus of elasticity, while moderate to heavy staining caused a significant decrease, which, however, may safely be neglected for all practical purposes.

31.42 : 31.27 : 12.2. FINDLAY, W. P. K., and PETTIFOR, C. B. **Effect of blue stain on the strength of Obeche [*Triplochiton scleroxylon*].** *Emp. For. J.* 18, 1939 (259–67).

A series of mechanical tests were carried out on small selected samples of Obeche cut from a freshly imported log. One set of tests was made on samples which were exposed under controlled conditions to infection with *Botryodiplodia theobromae*, a fungus which frequently causes staining of this timber in the log, and the other set of tests was carried out on carefully matched control samples. In each case one-half of the samples were sterilized by intermittent steaming.

Infection with the fungus brings about (*a*) marked reduction in toughness amounting in one group of heavily stained specimens to 43 per cent., (*b*) a definite reduction in bending strength which in one group amounted to 19·7 per cent., (*c*) a reduction of about 7 per cent. in stiffness in the unsterilized timber, and a negligible change in the sterilized timber, (*d*) a reduction in specific gravity—the maximum loss found amounting to 12·5 per cent.

Chemical analysis of the heavily stained samples shows that the fungus causes a marked depletion in the content of water-soluble materials, and that it also attacks the cellulose, pentosans, and lignin, behaving like a typical white rot fungus. *From authors' summary.*

31.42 : 31.43 : 13.2. STEINER, P. Ist verblautes Holz vor Hausbockbefall geschützt?

[Is sap-stained timber protected from attack by *Hylotrupes bajulus?*] *Anz. Schädlingsk.* 15, 1939 (125–8). [G.] [Holzschutzlaboratorium der Alkaliwerke Westergeln G.m.b.H.]

According to investigations by the author and other workers, sap staining is no protection against attack.

31.42 : 33.52. WECHEL, A. TE. Verdere gegevens over de duurzaamheid van heiningpalen. **[Further data on the durability of fence posts.]** *Ned. Boschb.-Tijdschr.* 12, 1939 (341–51). [Du.]

Records have been kept of the progress of decay in 464 untreated fence posts, made of various kinds of wood and buried in 1926 to a depth equalling one-third of their length. After 13 years' service 56 of the posts are still sound. A high proportion of coloured heartwood was found to be correlated with increased resistance to decay. The results of the tests indicate the following order of durability for the various species used: (*a*) very durable—*Picea sitchensis*, *Larix leptolepis*, *L. europaea*, and *Quercus robur*, provided that a high proportion of heartwood was present; (*b*) durable—*Pseudotsuga douglasii* ('green' and 'grey' varieties) and *Quercus rubra* (if heartwood was present); (*c*) moderately durable—*Pinus nigra* vars., *austriaca* and *corsicana*, *P. maritima*, *P. strobus*, and *Abies alba*; (*d*) durability poor—*Salix alba*, *Picea excelsa*, and *Pinus banksiana*; (*e*) not durable—*Pinus sylvestris* (except the heartwood), *Quercus robur* (sapwood), and *Q. rubra* (sapwood). Significant points are said to be that (*a*) Sitka Spruce posts 10 cm. in diameter, with about 30 annual rings and heartwood amounting to 0·57 of the total diameter, lasted more than 15 years; (*b*) of Larch posts 8 cm. in diameter, with about 25 annual rings and heartwood amounting to 0·65 of the total diameter, about 60 per cent. remained intact for the same period; (*c*) a similar percentage was recorded for Japanese Larch posts 8·5 cm. in diameter with about 14 annual rings and heartwood in the proportion of 0·79 of the total diameter. The conditions of the test were severe, and normally greater durability might be expected than that shown during the test.

31.42 : 33.36. **Cause and prevention of blue stain in wood.** *Tech. Note* No. 225. [U.S.D.A. Division of Forest Pathology, Bureau of Plant Industry in co-operation with For. Prod. Lab., Madison.] 1938. pp. 4.

Blue stain is caused by fungi which grow in sapwood, and their growth is most rapid at a temperature of 75 to 85° F. The ends and barked areas of freshly cut hardwood logs should be sprayed with a 5 per cent. solution of Dowicide H (sodium tetrachlorophenolate plus excess alkali), Santobrite, or Dowicide G (both sodium pentachlorophenolate plus excess alkali), or with a 2 per cent. solution of Lignasan (ethyl mercuric chloride plus inerts) to retard blue stain during storage up to 3 months. Softwoods are not protected for as long as hardwoods and for them a 5 per cent. solution of Dowicide P (mixture in equal proportions of sodium tetrachlorophenolate and sodium 2-chloro-o-phenylphenolate plus excess alkali) may be preferable to Dowicide H.

To control stain in lumber, kiln-dry the stock green from the saw. Stock to be air-dried can be protected by dipping, using Dowicide G, Dowicide P, Lignasan, and Santobrite, for both hardwoods and softwoods, Dowicide H for hardwoods, and soda solution (60 lb. per 100 gals. of water) at 160° F. for softwoods. For effective spraying or dipping, logs should be stain-free, treated promptly, thoroughly covered with an adequate concentration of chemical, protected from rain, and properly seasoned. For long time protection seasoned wood should be kept at a 20 per cent. or less moisture content, or should be chemically treated under pressure.

31.42–3 : 33.36 : 32.8 (485). BUTOVITSCH, V., and SPAAK, H. Studier och försök att skydda i skogen kvarliggande timmer mot insekter och svampar jämte beräkningar av konserveringsmetodernas ekonomiska förutsättningar. **[Studies and experiments on the protection against insects and fungi of logs left in the forest, with calculations of the profitability of the methods of preservation employed.]** *Norrlands SkogsvFörb. Tidskr.* No. 3, 1939. pp. 120. [Sw.g.]

Two storms, in September 1937 and March 1938 respectively, overturned some 400,000 cu. m. of Scots Pine and Norway Spruce in southern Hälsingland, central Sweden. Much of the storm-thrown timber had to be left in the woods over the ensuing summer, and in an effort to save this various protective measures were tried. Some of the logs were sprayed before stacking with chemical preservatives, including (*a*) a carbolineum preparation known as Carbokrimp in 15 and 20 per cent. aqueous

emulsions, (*b*) a fungicide called Rustikol, used undiluted, and (*c*) several solutions of different arsenical salts. The logs, barked or unbarked, were stacked and covered on all sides of the stacks with a layer of Spruce slash or moss. Stacking sites were chosen so that the degrees of soil moisture and illumination were suitably varied. A further method of protection tried was the storing of unbarked logs in a trench in wet peatland and covering with a layer of sphagnum to a depth of 20–30 cm.

Examination in October 1938 showed that Pine was much more seriously attacked by insects than Spruce. The fauna of infested logs consisted mainly of species inhabiting stumps and roots, such as *Hylastes* spp., and *Dryocoetes*; a conspicuous feature was the absence of species commonly infesting fallen trees, such as *Ips typographus*, *Pityogenes chalcographus*, *P. quadridens*, *Orthotomicus proximus*, and *Monochamus sutor*. In Pine there was little difference in infestation between the upper and lower sides of logs, but in Spruce attacks on the upper surface were considerably stronger. The frequency of attack generally increased with increasing height of the log in the stack. Top logs were more heavily attacked than middle and butt logs.

The incidence of insect attack and sap stain showed fair agreement, and the correlation was particularly close when the extent of sap stain was compared with the frequency of insects that breed in the bark. Chief of these insects were *Blastophagus minor* and *Hylastes ater* on Pine, and *Tetropium*, *Dryocoetes*, and *Hylastes cunicularius* on Spruce. The first-named in particular was closely associated with serious sap stain. When insect attack was constant, infection by sap-staining fungi decreased with increasing moisture of the substratum.

Sap stain caused by mechanical injuries during felling, skidding, and trimming was of small extent compared with that associated with insects, and normally it penetrated only a short way into the wood and showed little lateral spreading. Within the stack, sap stain due to both causes increased with increasing height of the logs. Owing to numerous trimming wounds, top logs were more heavily infected than middle and butt logs.

For the stack as a whole no clear correlation was found between insect attack and soil moisture, though in the bottom layer of logs, where soil moisture exerted the greater effect, there was a marked drop in both insect attack and sap stain. The lack of a correlation throughout the stack is attributed to the drying out of the slash covering.

There was no obvious connexion between illumination and insect attack, but the extent of sap stain was much reduced by shading. If, however, the slash covering offered an efficient protection against drying out, shading had no effect.

Among the chemical preservatives, Carbokrimp had no insecticidal and scarcely any fungicidal effect; Rustikol, on the other hand, had a certain protective value against sap stain on the barked portions of logs. Of the arsenical preservatives only two could be judged, as the logs treated with other preparations were too few to give reliable results. 'Bolidens Impregneringssalt' in a 5 per cent. solution was not effective against insects, but stacks sprayed with 5 per cent. sodium arsenite solution showed the least insect attack of all. On the other hand, logs treated with the arsenical preparations were very heavily infected with sap stain, such compounds appearing even to stimulate the growth of the fungi.

The best results as regards both insect attack and sap stain were achieved by storage of the logs in wet peatland, due to a large increase in the moisture content of the logs.

A certain amount of the timber investigated was later sawn up into boards and the extent of damage by sap stain and rot fungi estimated. The results with sap stain agreed substantially with the field observations. Unbarked top logs suffered more from rot fungi than unbarked butt logs: in barked logs there was no significant difference. In contrast to sap-stain fungi, the rot fungi did less damage to well illuminated stacks. Spruce suffered more damage from rots than Pine.

A number of windfalls was also examined *in situ*. These had a different insect fauna, *Blastophagus* spp. being much more frequent, and *Hylastes* spp., *Hylurgops palliatus*, and *Dryocoetes* much less frequent than in stacked material. The influence of soil moisture, shade, and position of wood in the tree was essentially similar to that in the stacked timber. Spruce suffered much less from all kinds of attack than Pine, but the ratio of sap stain and rot differed in the two species, Spruce suffering more from rots and Pine more from sap stain.

On the basis of the results given by the sawn boards it is calculated that Pine of the fourth quality and under will not pay for treatment,

while the economic limit for Spruce lies somewhat higher. With the exception of storage of barked Pine logs, all the methods employed are shown to be economically justified.

31.43. Attack by Animal Organisms

31.43. CRAIGHEAD, F. C., ST. GEORGE, R. A., and WILFORD, B. H. **A method for preventing insect injury to material used for posts, poles, and rustic construction.** *E-409.* U.S. Dep. Agric. Bureau of Entomology & Plant Quarantine, Washington, D.C. 1937. pp. 7.

Various methods of injecting chemicals into the sap stream of living trees.

31.43 : 12.11 : 12.2 : 13.2. PARKIN, E. A., and PHILLIPS, E. W. J. **The depletion of starch from timber in relation to attack by *Lyctus* beetles. IV. A third experiment on the girdling of standing Oak trees.** *Forestry* 13, 1939 (134–45). [Forest Products Research Laboratory, Princes Risborough, Bucks.]

Twenty Oaks (*Quercus robur* L.) were girdled 16 ft. above ground, 10 in May and 10 in July 1938, to study the variation in starch depletion. Considerable variation was recorded within trees and between trees, and the factors that favour depletion appear to be narrow sapwood, high recent growth rate, a vigorous but compact crown, and a long clean bole free from epicormic shoots. Depletion continued until January 1939, although no winter loss occurred in controls, suggesting that dormancy is normally caused by respiration-inhibiting substances from the crown rather than low temperature. The final classification agreed with a previous experiment and showed three trees still having sufficient starch for *Lyctus* powder post beetle attack, nine being non-susceptible and eight partially susceptible. The method is considered insufficiently reliable for general commercial production of *Lyctus*-immune Oak sapwood unless treatment is confined to selected trees. In the present instance the treatment cost 0·45 pence per cubic foot of timber below girdle. *From authors' summary.*

31.8. *Defects of Timber*

31.8 (91). DESCH, H. E. **Defects.** *Malay. Forester* 8, 1939 (173–9).

A discussion of defects in relation to Malayan timbers.

32. HARVESTING OF WOOD. LOGGING

32 : 33 (74.2). HOPKINS, G. M. **Lumbering and forestry in New Hampshire.** *J. For.* 37, 1939 (788–91).

The establishment of a number of small mills throughout the state is suggested as one means of dealing with the lumber problem.

32. KOLBE, E. L., and MCKAY, D. F. **Seven methods of cutting tested at Pringle Falls.** *For. Res. Notes Pacific Northwest For. Exp. Sta.* No. 27. 1939. (8.)

Selective harvesting of varied intensity in virgin Ponderosa Pine.

32. SWAN, O. T. **The viewpoint of the lumberman on selective logging.** *J. For.* 37, 1939 (705–11).

32.1. *Marking of Trees and Coupes*

32.1 : 21.6 (78.7–8). TAYLOR, R. F. **The application of a tree classification in marking Lodgepole Pine for selection cutting.** *J. For.* 37, 1939 (777–82). [Rocky Mt. Forest and Range Exp. Sta.]

Four vigour classes are differentiated on the basis of crown area, crown length, and crown vigour. In applying this classification the proportion of merchantable volume in each class should be determined from sample strips. As a guide to selection cutting it appears that a reserve stand of 5,000 board feet per acre and a 30-year cutting cycle give the highest yields for this species in Colorado and Wyoming, and that the reserve stand should never be below 3,500 bd. ft.

Furthermore, it is shown that acceleration in the growth of reserved trees is in direct relation to the vigour of the tree and the amount of release, that maximum acceleration in growth is reached 14 to 18 years after release, and that in 60 years after cutting the growth rate is back to normal. A correlation is shown between response to release and diameter class up to the 12-in. d.b.h. class, the smaller the tree the greater the response, while trees from 12 in. to 18 in. d.b.h. respond in much the same degree. Based on these data the selection should remove all trees 17 in. d.b.h. and larger, all trees in the fourth vigour class (D) and all those in the third class (C) not required in the reserve stand. All reserved trees should be released as much as possible. Trees in the first two classes (A and B) should not be cut unless defective or their volume exceeds 5,000 bd. ft.

32.2. *Felling. Extraction*

32.2 : 07.7 (494). James, N. D. G. **Swiss faggot tyer.** *Quart. J. For.* 33, 1939 (259–61). The construction is explained and illustrated.

32.2 : 32.7 (91.4). Lansigan, N. P. **'Flanging' system increases timber utilization. A preliminary report on Insular Lumber Company's new process.** *Philipp. J. For.* 2, 1939 (209–23).

This process depends on the removal of high buttresses from many Philippine timber species preparatory to tree felling, thus reducing the great wastage from high stumps.

32.2 : 07.7. **Strawline drums boost log output.** *Timberman* 41 (1), 1939 (14–15, 22).

At Shelton, Washington, two RD8 'caterpillar' Diesel units, converted into Hyster donkey tractors, were fitted with Hyster strawline drums, resulting in a considerably increased log production. The mechanical points and utility of the drum are detailed with illustrations.

32.3. *Sorting according to Final Products*

32.3 : 52 (485). Svensson, I. A. Timmer — massaved. Rationell aptering. [**Timber and pulpwood. Rational scaling.**] *Skogsägaren* 15, 1939 (297–301). [Sw.]

Examples of the procedure to be followed in making up a scaling table designed to show the most profitable way of dividing logs into timber and pulpwood lengths according to the dimension prices prevailing in any given district.

32.3 : 12.2 (91.4). Mabesa, C. **The yield of bark of Pototan [*Bruguiera gymnorhiza*] and Bakauan [*Rhizophora apiculata*] and the relation of its green weight to the volume of wood.** *Philipp. J. For.* 2, 1939 (93–117).

Surveys of Mangrove Swamps in two areas gave the figures of 42 metric tons of bark and 222 cubic metres of wood per hectare for one area and 21 metric tons of bark and 119 cubic metres of wood per hectare in the other. The two species measured were Bakauan (*Rhizophora apiculata*) and Pototan (*Bruguiera gymnorhiza*). By means of regression curves it was determined that diameter of the tree has 57 times as much influence on the yield of Bakauan bark as has the length of bole. For Pototan the influence of diameter is only 1·2 times that of length and the tendency is for all tall trees to have a relatively thin bark.

It was also determined that the yield of bark for both species is a function of diameter and length of bole, and that the relation between weight of green bark and volume of green wood for the two species is a straight line.

32.3 : 12.2. Vogel, K. Eine graphische Sortentafel für Buche. [**A graphic table of assortments for Beech.**] *Allg. Forst- u. Jagdztg.* 115, 1939 (291–300). [G.]

32.5. *Logging Costs*

32.5 : 32.2. Matthews, D. M. **The use of unit cost data in estimating logging costs and planning logging operations.** *J. For.* 37, 1939 (783–7). [University of Michigan.]

The economic spacing of logging roads will vary with cost of road construction, volume per acre of stand to be cut, and hauling cost per unit of volume and distance in the woods. Where the economic spacing of the roads is relatively wide, the tractor is the most efficient skidding device, while close spacing of the roads will tend to favour skidding by team or other methods having low fixed costs. The specific data presented indicates 1,200 ft. as the maximum distance between roads at which team skidding is efficient with an average skidding distance of 300 ft.

32.5 : 33.0 : 33.32 (75–6). Barrett, L. I., and Renshaw, J. F. **Factors affecting the costs of producing Oak cordwood.** *J. For.* 37, 1939 (947–54). [Appalachian Forest Exp. Sta.]

An analysis of cost data relating to the production of Oak cordwood from material left after a stand improvement logging operation in the mixed Oak type.

32.5 : 33.32. Goulet, E. R. **Economics of logging various pulpwood lengths.** *Woodlands Rev.* 10, 1939. pp. 3. [Canadian International Paper Company.]

The main arguments in favour of 4-ft. lengths are: (1) Branch stream improvements and driving cost lower. (2) Slashing at the mill eliminated. (3) Branch stream inventories lower. (4) Supervision simplified. Arguments in favour of log lengths are: (1) Landed cost lower under normal conditions. (2) Easier application of mechanical logging. (3) Safer handling on large rivers or in holding booms.

(4) Variable utilization. Stumpage may be higher or lower in either case depending on Government Regulations. *From author's summary.*

32.7. *Loss in Logging*

32.7 : 32.2 : 33.32. **Effect of utilization standards on pulpwood yield.** *Tech. Note Lake States For. Exp. Sta.* No. 150. 1939. pp. 1.

Exempifies the gain in yield from cutting logs into 100-in. bolts with a minimum top diameter of 3 in. If logs are cut to a top diameter exceeding this figure the loss of utilizable wood is considerable, particularly in trees of low d.b.h.

32.7 : 32.2 : 33.32. **Pulpwood volume losses due to peeling and shrinkage.** *Tech. Note Lake States For. Exp. Sta.* No. 151. 1939. pp. 1.

The average volume reduction due to barking pulpwood logs of *Pinus banksiana* was 9·3 per cent. Barked logs also lost about 2·5 per cent. of their volume in 150 days through shrinkage.

33. CONVERSION AND PRESERVATION OF WOOD

33 : 09.4 (47.1). KURTÉN, H. J. **A survey of the forest industries of Finland.** The Paper Makers' Association of Great Britain & Ireland, Shell-Mex House, Strand, London. 1939. pp. 22.

33 : 01 : 09.4 (71 : 73). HELLMAN, F. S. **A selected list of recent references on the lumber industry of the United States and Canada.** Library of Congress, Division of Bibliography. 1939. pp. 34.

33 : 98 (73). **The lumber industry, including a list of selected trade associations.** Prepared by the Marketing Research Division [Trade Association Section] and the Forests Products Division, Bureau of Foreign and Domestic Commerce, U.S. Department of Commerce. *Market Research Series* 10 (4), Bureau of Foreign and Domestic Commerce, Washington, D.C. 1936. pp. 69.

33.0. *Raw Materials*

33.0 : 33.8 (47.1). WIGELIUS, E. Trävirket i flygplanskonstruktionen. [**Wood in aeroplane construction.**] *Skogsägaren* 15, 1939 (223–7). [Sw.]

The leading timbers of the world for aeroplane construction are the American Spruces, *Picea sitchensis*, *P. rubra*, and *P. glauca*, the first-named being the most used. In Finland, Scots Pine is always used, for although Norway Spruce has the required strength, it is not obtainable in large dimensions free of defects, and even with Scots Pine difficulty is experienced in securing quantities of straight-grained knotless wood of the required size. Scots Pine is rather stronger but slightly heavier than the Spruces; it will fulfil the strength requirements for aeroplane construction if its specific gravity at 15 per cent. moisture content is not less than 0·42. The wood used in Finnish factories is procured either direct from the forest through the agency of the local forestry authorities, or else from the sawmills in the form of boards. Rigorous attention is paid to the selection of suitable trees, which must come from approved sites where the conditions of growth are suitable. The best trees are said to grow in mixture with Spruce in the '*Myrtillus*' and '*Oxalis*' forest types. Sample trees are bored to determine the proportion of summerwood. At first, stems had to be at least 15 in. in diameter at a height of 16 ft., but sufficient stems of this size are no longer obtainable, and since laminated and boxed construction has made possible the utilization of smaller dimensions, the diameter limit has been lowered to 11 in. at a height of 12 ft. The best stemwood is employed for the major functional structures of the aeroplanes, while wood of inferior strength and remnants of the first-class wood are used in structural details where no great strain is imposed.

33.11. Tools. Implements. Machines

33.11 : 33.17 (77.5). **New band mill designed for permanent or portable operation.** *Timberman* 40 (11), 1939 (28).

A 54-in. band mill recently announced by Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin.

33.11. **The care and use of circular saws in wood-working plants.** Simonds Saw & Steel Co., Fitchburg, Massachusetts. 1939. pp. 72. Univ. Calif. Coll. Agric. For. Dep. Libr. Acc. 5, 4 (5).

33.11 : 33.7. TRYON, H. H. **A high-duty woodsaw.** *Black Rock For. Pap.* 1 (15), 1939 (100–2).

Details of an economical power-driven portable circular saw for converting firewood poles into 4-ft. lengths in the woods, with notes on the operation of the unit in practice.

33.15. Manufacture of Veneers and Laminated Wood. Gluing

33.15 (54). NAGLE, W. **Veneers.** *Woodworking Series* No. 1. Forest Research Institute, Dehra Dun, U.P., India. 1938. pp. 7.

A discussion of the production of sawn and sliced veneers and of the drying and storing, and use of the latter type. A list is given of some Indian timbers that might be used for sliced veneers. Details are given of the equipment necessary for a slice veneer plant, its cost, and the cost, income, and profit in connexion with the manufacture of this product.

33.15. HORWITZ, S. **Adhesives—natural glues in the veneer and plywood industry.** *Wood* 4, 1939 (462–5).

Wood glues are classified and the vegetable and animal glues are described with details as to their use, and the technique of application and of drying.

33.15. JABLONSKY, B. **Improvements in the manufacture of laminated wooden blocks.** *Patent Specification* 502,826. H.M.Stationery Office, London. Mar. 27. 1939. pp. 3. P.R.

33.15 : 01. **List of publications on glue and plywood.** Forest Products Laboratory, Madison, Wisconsin. 1939. pp. 10.

33.15 : 31.27. RUST, S. F. **Shear strength and water resistance of casein and Tego bonded Hoop Pine plywood.** *Aust. Timb. J.* 5, 1939 (603–4). [Division of Forest Products, C.S.I.R.]

Tego-bonded plywood is stronger than the casein-bonded material when tested dry and is also more water-resistant. Both classes of plywood recover their original shear strengths when tested dry after 24 or 48 hours' cold soaking. Three hours' boiling decreases the shear strength of the casein-bonded material when tested dry. Tego-bonded plywood is 'waterproof' and casein-bonded material 'highly water-resistant'. *From author's summary.*

33.16. Wood Wool Manufacture

33.16 : 34.6 : 07.7 (94). DIXON, C. E. **An artificial dryer for wood wool.** *Aust. Timb. J.* 5, 1939 (475–9, 499–502).

Design and efficiency data for a simple, commercially suitable dryer, evolved from recent experiments at the Melbourne Forest Products Laboratory.

33.3. *Chemical Treatment*

33.3. HARRIS, E. E., and MITCHELL, R. L. **Effect of various pre-extractions on the lignin determination of wood.** Forest Products Laboratory, Madison, Wisconsin. 1939. pp. 3.

Lignin is soluble in dilute acid solutions, and is precipitated by long heating, heating under pressure, or increased acid concentration. Extraction of lignin-containing material with 3 per cent. acid, sodium sulphite, and other salts or bases removes lignin and should be avoided if an accurate determination of the lignin content of a sample of wood is desired. *From authors' summary.*

33.32. Pulp and Paper Manufacture

33.32 : 12.2 (67.8). **Mangrove woods from Tanganyika for paper-making.** *Bull. imp. Inst., Lond.* 37, 1939 (331–44).

From recent investigations by the Imperial Institute, it appears unlikely that a profitable outlet could be found for the woods of Makandaa (*Ceriops candolleana*), Mchuu (*Avicennia officinalis*), and Makaka (*Rhizophora mucronata*) as raw materials for paper making.

33.32 : 32.5 : 33.0 (75.5–7). CUNO, J. B. **Production of Loblolly Pine pulpwood in the mid-Atlantic region.** *Repr.* from *Southern Pulp & Paper J.* 1939. pp. 12.

Information on production costs by tree sizes is most important in determining the diameter limit at which it is profitable to cut. Small trees that are cut for pulpwood, although above the minimum size limit acceptable by the mills, may not bring sufficient return to pay for stumpage. This condition is emphasized when the volume of bolts of small diameter is based on solid content. Although the clear cutting of an uneven-sized forest may produce the highest yield per acre, it does not necessarily give as high a monetary return per cord of wood as when only large trees are cut. The cost of peeling pulp logs in the woods is directly affected by the size of log and ease of peeling. Machine peeling has possibilities with further development of the equipment. The cost of transporting pulpwood, whether by truck, barge, freight

car or vessel, is directly affected by distance, but proportionately most by truck and railroad. Trucks are the most efficient transportation on partial cutting operations and small volumes can be hauled by them as cheaply per unit as large ones. In seasoning 5-ft. lengths of peeled pulpwood, practically half the loss in weight occurs in the first 30 days, and the smaller the diameter the more rapid the loss in weight. The measurement of pulpwood on a solid volume or weight basis is more equitable than on a cord basis and this method has been found to be practicable.

33.32 : 07 (76). WINSLOW, C. P. **Contributions of Forest Products Laboratory research to Southern pulp and paper developments.** Forest Products Laboratory, Madison, Wisconsin. 1939. pp. 6.

33.32 : 31.3 (91.1). MIURA, I., and KITANO, S. **Researches on tropical woods for the manufacture of pulp. IV. Chemical composition of British North Borneo woods.** *Cellulose Ind. Tokyo* 15, 1939 (167–70). [Jap.e.] [Faculty of Agriculture, Tokyo Imperial University.] L.S.

33.32. BROOKBANK, E. B. **The sulphite pulping of Douglas Fir.** *Paper Tr. J.* 108 (7), 1939 (30–8). [The Mead Corporation, Chillicothe, Ohio.] P.R.

A sample log of Douglas Fir was pulped in a sulphite cooking liquor containing 1·25 per cent. combined and 6 per cent. free sulphur dioxide and the liquor ratio used was 7 to 1. Maintaining a mild cooking action over a fairly long period it was found that sapwood or a mixture of 85 per cent. sapwood and 15 per cent. heartwood, by weight, could be pulped in 10 hours at 140 to 145° C. Douglas Fir pulps have a high tear and low apparent density, and a high content of alpha-cellulose while being low in pentosans.

33.32. MCMILLEN, J. M., GORTNER, R. A., SCHMITZ, H., and BAILEY, A. J. **The cooking process. Butanol cooking of hardwoods and softwoods.** *Industr. Engng. Chem.* 30, 1938 (1407–9). [Minnesota Agricultural Exp. Sta., St. Paul, Minn.] P.R.

Six hardwoods and six softwoods were cooked with aqueous butanol. Analyses of original woods and residual pulps were made for Cross and Bevan cellulose, alpha-cellulose, pentosans, lignin, and ash. The hardwoods were all pulped satisfactorily, but the softwoods were only partially pulped and had a much greater proportion of lignin resistant to butanol delignification than had the hardwoods. Birch and Basswood were more efficiently delignified than the other woods in their respective classes. Cellulose is recovered from Aspen in higher yields than from the other hardwoods. The pulping action is so similar on all the hardwoods that they might well be cooked together in varying mixtures. All of the hardwoods yield pulps which, so far as the analyses are concerned, would be satisfactory commercial pulp. None of the softwoods yielded pulps which were analysed as being commercially satisfactory. *From authors' summary.*

33.32. SHERRARD, E. C., BEGLINGER, E., and HOHF, J. P. **Wood plastics as developed at the Forest Products Laboratory and their future importance.** Forest Products Laboratory, Madison, Wisconsin. 1939. pp. 5.

33.32 : 11.14 : 31.1. WEIDNER, J. P. **The influence of humidity on changes in diameter and length of sulphite fibers.** *Paper Tr. J.* 108 (1), 1939 (31–40). P.R.

33.32 : 12.2. BRAY, M. W., MARTIN, J. S., and SCHWARTZ, S. L. **Sulphate pulping of Silver Fir. Effect of chemical concentration and of wood selection on yield and pulp quality.** *Paper Tr. J.* 109 (18), 1939 (29–36). [Forest Products Laboratory, Madison, Wis.] P.R.

Abies amabilis is suitable for the manufacture of both kraft and bleachable sulphate pulps. Top logs gave the highest yield of kraft pulp, which had higher folding and bursting strengths, but a lower tearing strength, than pulp made from butt logs. The yield of pulp from slabwood was slightly higher than that from heartwood, and the pulp obtained had a higher tearing strength and lower bleaching requirement than heartwood pulp. Neither slabwood nor heartwood pulps excelled in other strength properties. For producing bleachable pulps, selection of raw material is probably less important, but here also the upper logs and slabwood gave the highest yield of pulp. Notes are included on the influence of total chemical concentration of the cooking liquor upon the yield and strength of pulps.

33.32 : 12.2. STUDENY, J., and LIBBY, C. E. **The suitability of Red Pine for the manu-**

facture of sulphite pulp. *Paper Tr. J.* 109 (20), 1939 (29–35). [New York State College of Forestry, Syracuse, N.Y.]. P.R.

Wood from 23-year-old *Pinus resinosa* was found suitable for the manufacture of high-grade sulphite pulp. Yields of 45–50 per cent. were obtained, the pulps containing 80–5 per cent. of alpha-cellulose with very little residual lignin and a fairly low percentage of pitch. The product compared favourably with high-grade newsprint sulphite. Data are given on cooking periods and temperatures, and on the effect of various liquor bases. Wood from mature Red Pine was treated in the same way, but proved unsuitable on account of its high pitch content, which prevented the penetration of the cooking liquor and thus resulted in an excessive yield of screenings. Though strong, the pulp obtained from mature wood contained a large amount of pitch, was very hard to bleach, and had a tendency to redden after standing overnight.

33.32 : 22 : 01. **Some references on the cultivation and use as pulpwood of conifers and Birch.** *Sci. Libr. Bibliogr. Ser.* No. 333. 1939 (reissue). pp. 11.

33.32 : 31 : 56 : 12.2. CHIDESTER, G. H., BRAY, M. W., and CURRAN, C. E. **Growth factors influencing the value of Jack Pine for kraft and sulphite pulps.** *Paper Tr. J.* 109 (13), 1939 (36–42). P.R.

Tests of wood from an even-aged, naturally grown, 48-year-old Jack Pine stand showed that density, summerwood content, and heartwood content decreased with increasing height of tree and generally with increasing diameter at breast height. In general the trends in yield and quality of pulp for the different classes of material examined were quite similar for both the sulphate and sulphite processes. The yield of pulp per unit volume of wood was considerably higher for the slower-growing, suppressed trees and for the lower portions of all the trees than for the less dense wood occurring in specimens showing more rapid growth and in the upper portions of the trees, and the yield decreased somewhat as tree diameter increased. The strength of the pulp obtained from butt wood was appreciably lower than that from the middle logs or the tops. The sulphite pulping experiment showed possibilities of a much more complete conversion than has ordinarily been realized in practice.

33.32 : 31.3 : 12.2. FUKUDA, Y. **Research on celluloses. XIV. Delignification of Larch wood from Honsyu by the sulphite cooking process. II.** *Cellulose Ind. Tokyo* 15, 1939 (154–7). [Jap.g.] [Chemisch-Technisches Institut, Kaiserl. Universität zu Kyoto.] L.S.

33.32 : 31.3 : 12.2. KIMOTO, M. **Research on celluloses. XV. Analysis of 'Red Pine'.** *Cellulose Ind. Tokyo* 15, 1939 (158–60). [Jap.g.] [Institut für Chemische Forschung, Kaiserl. Universität zu Kyoto.] L.S.

33.35. Seasoning. Drying

33.35 (56.43). DANKS, F. S. **Air-seasoning of timber.** *Tech. Pamphl. For. Dep. Cyprus* No. 3. 1939. pp. 16.

Wood should be converted as soon after felling as possible and placed at once on the seasoning stack. Quarter-sawn timber is relatively free from twisting, warping, or shrinking. Proper piling of green wood is essential from the start and the best method of piling and the best size of 'sticker' can only be determined from experience. Piles should be at least 3 ft. apart, and may be 10 to 12 ft. wide, 14 to 18 ft. high, and the supports of the piles, old rails or creosoted timbers resting on stone, should be 2 ft. above ground. The site for the piles should be well drained, cleared of all vegetation and timber that is decayed or infected with insects. The piles should be so arranged that the prevailing winds blow across the breadth of the boards.

A pitprop with a moisture content of 14 per cent. has 50 per cent. greater strength than one with 27 per cent. (fibre saturation point) or more moisture content. Props that are seasoning in the open should be protected from rain, so that all have a uniform moisture content when put into use.

33.35. BATESON, R. G. **Timber seasoning.** *D.S.I.R., For. Prod. Res. Rec.* No. 4 [*Seasoning Series* No. 1]. 2nd ed. H.M. Stationery Office, London. 1938. pp. 15.

Softwoods that are susceptible to sap-stain fungi should be air-seasoned in the spring. Otherwise the winter months are the best time for this treatment. Foundations of piles should be about 2 ft. apart running the length of the pile and giving a clearance of about 18 in. above ground. Seasoned softwood piling sticks 1 in. thick should be used in vertical alinement. Stacks should not be more than 6 ft. wide and may be placed 1 ft. apart, and each should be

provided with a pitched roof. To air season to a 20 per cent. moisture content, 1 in. softwoods piled in spring require 2 to 3 months, 2 in. softwoods 3 to 4 months, 1 in. hardwoods, piled in the autumn, about 6 months, and 2 in. hardwoods about one year.

In dry kiln seasoning, stacks should never be more than 8 ft. wide and usually not exceed 6 ft. Timber may be laid edge to edge in forced draught kilns but pieces should be 1 in. apart in the natural circulation type. Air seasoning to 20 per cent. moisture content followed by kiln drying is a most efficient method of treatment, particularly for difficult woods. Suggestions are given on the prevention of specific degrades in kiln seasoning.

33.35. **Seasoning of Taeda Pine and Caribaea Pine for fruit cases.** *Aust. Timb. J.* 5, 1939 (471).

Of the methods tested to obtain quick and effective air seasoning of case boards, only the small haphazard pile, the end racked, and the 1 in. stripped boards, all under cover, were free from degrade. The times required for these methods are as follows:

Manner of Stacking (Boards 3 in. × ⅜ in. × 26 in.)	*No. of inclusive days drying to less than 20 per cent.*
Under cover: (1) Racked on end	Less than 6
(2) Haphazard	8
(3) 1 in. strips	9

The self-stripped and block-stacked methods under cover resulted in blue stain and mould and all methods were unsuccessful in the open.

33.35 : 33.7 : 12.2. KAPUR, S. N., and REHMAN, M. A. **A note on the dryage of Sal fuelwood.** *Indian For.* 65, 1939 (734–8). [Forest Research Institute, Dehra Dun.]

The percentage loss of weight depends on the season of stacking and varies from 25 per cent. to 45 per cent. of the original weight. The material stacked in summer starts from a lower moisture content as a result of loss of moisture before stacking. For complete drying to about 10 to 14 per cent. moisture content, 6 to 12 months are necessary. *From authors' summary.*

33.36. Preservation of Wood. Impregnation

33.36. BAECHLER, R. H. **A method for determining chlorinated compounds dissolved in petroleum oils.** *Proc. Amer. Wood Pres. Ass.* 35, 1939 (361–4).

33.36. BAECHLER, R. H. **Corrosion of metal fastenings in zinc-chloride treated wood after ten years.** *Proc. Amer. Wood. Pres. Ass.* 35, 1939 (56–63). [Forest Products Laboratory, Madison, Wisconsin.]

Provided that the wood had previously been seasoned, the corrosion of ordinary wire nails in wood treated with zinc chloride and exposed for 10 years to a fairly humid interior or to the outside conditions at Madison, Wisconsin, was not appreciably greater than in untreated wood. Nails driven into wet treated wood corroded rapidly during the period of drying; the use of wire nails in treated wood under very moist conditions is therefore inadvisable. Painting the wood or adding sodium dichromate to the preservative solution did not greatly modify the rate of corrosion in wire nails. Except under the most severe conditions of exposure, the corrosion of brass and galvanized iron fastenings in treated wood was found to be slight.

33.36. BAECHLER, R. H. **Toxicity of normal aliphatic alcohols, acids, and sodium salts.** *Proc. Amer. Wood Pres. Ass.* 35, 1939 (364–72). [Forest Products Laboratory, Madison, Wisconsin.]

In general, the toxicity of normal aliphatic alcohols, aliphatic acids, and sodium salts of the latter, increased with molecular weight until in each series a point was reached where the solubility was insufficient to give a lethal concentration. Up to these limits the logarithms of the molecular weight and the killing concentration show a linear relation, except for the lower members of the series. A table gives the toxicity of all the compounds tested, 13 of which are recommended for field tests.

33.36. DREFAHL, L. C., and BESCHER, R. H. **The effect of sodium dichromate on the preservative value of zinc chloride.** *Proc. Amer. Wood Pres. Ass.* 35, 1939 (30–53).

The addition of sodium dichromate has been shown by laboratory tests and accelerated field service tests to increase substantially the value of zinc chloride as a wood preservative. Wood impregnated with a mixture of 81·5 per cent. zinc chloride and 18·5 per cent. sodium dichromate at the rate of ¾ lb. per cu. ft. contains rather more than ½ lb. of unchanged zinc chloride per cu. ft. Treatment with the mixture is practically the same as for zinc chloride, except that the temperature of the solution should not exceed 160° F. Corrosion of treating plant and of metal in contact with the wood is said to be

materially less with the mixture than with zinc chloride alone. The mixture is not subject to any patent or proprietary rights.

33.36. LEUTRITZ, J. **Acceleration of toximetric tests of wood preservatives by the use of soil as a medium.** *Phytopathology* 29, 1939 (901–3).

In the revised method the blocks used for testing were placed in small wide-mouth screw-cap bottles, covered with soil, and the entire set-up sterilized. The blocks were then inoculated with pure cultures of the test organisms. By this method the decay of untreated blocks was unusually rapid and uniform. The moisture content of the soil was 20 per cent. on a dry-weight basis.

33.36. MASON, L. **'Ascu' wood preservative.** Forest Research Institute, Dehra Dun, India. 1939? pp. 2.

Failures of 'Ascu'-treated transmission poles in northern India are being investigated. The poles so far analysed contained less than the minimum absorption recommended and penetration was very shallow. Other variables are also being examined. In the meantime the efficiency of 'Ascu' treatment is uncertain and the Forest Research Institute is withdrawing its publication on this preservative in *Indian For. Rec.* (*n.s.*), *Utilization*, Vol. I, No. 6.

33.36. WICHT, H., and SCHULZE, B. Untersuchungen über das Osmose-Holzschutzverfahren unter Benutzung des Scheibenverfahrens. **[Research on the osmotic wood-preservative process, using the disc method.]** *Holz* 2, 1939 (384–6). [G.g.] [Staatliches Materialprüfungsamt Berlin-Dahlem, Institut für Werkstoff-Biologie.]

The process is used for unseasoned timber. Admixture of colloidal substances to the pastes appears advisable. A correct procedure gives good depth of impregnation and allows for a considerable shortening of the time normally required.

33.36. WIRKA, R. M. **Preservation of timber by the steeping process.** Forest Products Laboratory, Madison, Wisconsin. Revised ed. 1939. pp. 9.

The characteristics and use of zinc chloride, mercuric chloride, and sodium chloride are described. The method, cost, and effectiveness of the steeping treatment are discussed, and the treatment and service data are tabulated for posts of twelve species.

33.36 : 31.42 : 12.2. **British standard method of test for the toxicity of wood preservatives to fungi.** *British Standard* No. 838, 1939. pp. 17. P.R.

A standardized wood-block method is adopted, in which samples of wood, impregnated with preservative, are exposed for 3 months to attack by wood-rotting fungi grown in pure culture on a malt-agar medium in a Kolle flask. The material and procedure to be employed are specified in detail. The woods used are (1) sapwood of *Pinus sylvestris*, for which the appropriate test fungi are *Coniophora cerebella* (Idaweiche strain), *Lentinus lepideus* (*L. squamosus*), and *Poria vaporaria* (Eberswalde strain); and (2) outer wood of *Fagus sylvatica*, the test fungus being *Polystictus versicolor*. The woods are readily attacked by the fungi and are easy to procure and impregnate; the fungi have been chosen for their rapid growth, economic importance, and high resistance to various preservatives. Decay is estimated from the loss in dry weight of the wood brought about by the action of the fungus, and the toxicity of the preservative is calculated as the minimum number of kg. of preservative per cu. m. of wood necessary to prevent decay. The latter figure is usually expressed as the toxic limit (toxic range), i.e. the interval between the concentration that just permits decay and the next highest concentration that completely prevents it. Examples are given of the evaluation of results.

33.36 : 31.42 : 32.2. LEVÓN, M. **Some results of investigations dealing with the use of Birch as a raw material for the plywood industry.** *Papp. Trävarutidskr. Finl.* 21, 1939 (500–1, 539, 569–70). R.A.M. 19 (56).

Though felling trees in leaf reduces the moisture content of the logs and renders floating easier, there is greater risk of bacterial and fungal infection than in winter-felled timber. By the end of August or the beginning of September, however, trees may be felled without risk of serious attack from the micro-organisms that cause staining in stored wood. Good control of staining has been obtained by the Runbäck water-sprinkling method, in which the logs and the surrounding atmosphere are kept at a constant moisture level, only about 7 per cent. discoloration developing in the treated material after 5 months as against roughly 28 per cent. in the untreated. Promising results have also been obtained by applying

to the ends of the logs certain tarry substances, e.g. bitumen 80°/90°+10 per cent. creosote oil.

33.36:31.42:12.2. LINDGREN, R. M., and SCHEFFER, T. C. **Effect of blue stain on the penetration of liquids into air-dry Southern Pine wood.** *Proc. Amer. Wood Pres. Ass.* 35, 1939 (325–36). [Bureau of Plant Industry, U.S.D.A.]

The absorption of water over periods between ½ and 55 hours was greater in blocks of *Pinus taeda* stained by *Endoconidiophora moniliformis*, *Graphium rigidum*, and *Hormonema* sp. than in matched unstained wood. No relation was found between the amount of stain and the degree of absorption. Increased water uptake in stained wood was largely confined to the first ½ hour of soaking: after 5 hours the unstained controls took up as much or more water in a given time.

In bolts of *P. palustris* stained with *Ceratostomella pilifera* the uptake of creosote applied as a hot-and-cold bath or as a pressure treatment was respectively 110–40 and 140–50 per cent. greater than in the controls. The sapwood was completely penetrated in the stained wood, but only partly so in the unstained.

The increased penetrability of stained wood is attributed largely to partial breakdown of the ray parenchyma and some direct penetration of tracheid walls.

According to these results, discrimination against stained wood on the grounds of reduced penetrability is not justified. The present results, however, were obtained with air-dry wood, and many reported cases of reduced penetration in stained wood are probably due to a high moisture content of the wood rather than to a direct effect of the stain. Nevertheless, the results should not be taken as an argument in favour of extensive use of stained wood; under the present commercial conditions clean wood is to be preferred in most cases.

33.36:31.42. KARAKOULIN, B. P. **On the methods of testing antiseptics used in the control of house fungi.** *Sovetsk. Bot.* 1939 (57–65). R.A.M. 18 (720).

Anthracene oil and carbolineum for controlling *Merulius lacrymans* and *Coniophora cerebella* (*C. puteana*) were tested by a method in which the value of the antiseptic was assessed by the growth of the fungus on wood saturated with the antiseptic and placed in flasks containing fungus cultures on garden soil and wood. The oils used were diluted with benzol. Doses of anthracene oil of between 1 and 2 per cent. of the weight of the wood completely arrested the growth of the fungi, while 5 per cent. carbolineum retarded it to a slight extent only.

33.36:31.42:44.3. SOKOLOFF, D. V. **The toxic action of hydrogen sulphide on certain moulds and tree pathogenic fungi.** *Mitt. forsttech. Akad. Kirov* (*U.S.S.R.*) 51, 1938 (70–7). R.A.M. 18 (644).

Exposure for 1–6 hours to 5–14 per cent. solutions of hydrogen sulphide proved lethal to *Merulius lacrymans*, *Coniophora cerebella* (*C. puteana*), *Poria vaillantii*, and *Fusarium avenaceum*. Wood is penetrated to a depth of 1·5 cm. after 6 hours' contact with 10 per cent. hydrogen sulphide. Pine seedlings did not suffer from short exposures to 3–4 per cent. solutions.

33.36:31.45:07. BROWN, C. R. **Fire tests of treated wood partitions.** *Quart. nat. Fire Prot. Ass.* 32, 1938 (104–21). [U.S. National Bureau of Standards.] P.R.

Standard fire-endurance tests on Longleaf Pine partitions of various thicknesses, and treated with monammonium phosphate, indicate that concentration of treatment has little apparent effect on fire endurance, whereas design and thickness of panel are both important factors, although the latter becomes less important in the larger size ranges. Fire-tube tests, which indicate the tendency of wood to support combustion and spread fire, gave results that were definitely related to concentration of treatment. Time of flame penetration varies with thickness of specimen, and is affected by type of design and by relatively high concentrations of treatment.

33.36:31.45. KOBE, K. A., and GOIN, F. L. **Exothermal decomposition temperature of wood impregnated with flammable organic liquids.** *Industr. Engng. Chem.* 31, 1939 (1171–2). [University of Washington, Seattle, Wash.] P.R.

The exothermal reactions in the thermal decomposition of wood are distributed over a considerable range of temperature and depend upon the rate of heating. An apparatus and procedure have been developed which give reproducible results and allow the study of the effect of various materials on the exothermal decomposition temperature. The moisture in the wood has no effect on the exothermal decomposition temperature. Gasoline, kerosene,

and light oil lower the exothermal decomposition temperature, heavy oil causes no change, and creosote increases it. *Authors' summary.*

33.36 : 31.45. Somers, A. J., and Cossey, J. **Fire resistance application of boric acid and its salts.** *Fire Prot.* 11, 1939 (171–3). P.R.

Compounds of ammonia, boric acid, and phosphoric acid have been found to be the most efficient fire-retarding agents in the protection of materials ordinarily combustible. Really effective treatment of wood requires the impregnation of the chemical agent, which should therefore be water-soluble. The following mixtures have been found particularly successful in the treatment of wood for this purpose:

(*a*) Boric acid 60 per cent. plus borax 40 per cent.
(*b*) Monammonium phosphate 33 per cent. plus borax 67 per cent.
(*c*) Diammonium phosphate 80 per cent. plus boric acid 20 per cent.

Recommendations are also made for the fireproofing of fibre boards, textiles, and straw.

33.37. Distillation

33.37. Seidenschnur, F. **Distilling wood.** *Ger. Pat.* No. 674, 819. Apr. 22. 1939. [Cl. 10*a*. 18.01.] *Chem. Abs.* 33 [7094]. P.R.

Finely divided wood is intimately mixed with caustic alkali; after the addition of an alkaline earth oxide it is briquetted and the briquettes are treated at 400–50° with hydrogen or other gases free from carbon dioxide.

33.38. Charcoal Manufacture. Charcoal. Use of Wood in Power-gas Generators. Producer Gas

33.38 (485). Gengasdriftens förutsättningar. **[Requisite conditions for the use of producer gas as a motor fuel.]** *Skogen* 26, 1939 (433–4). [Sw.]

Interest in the use of vehicles driven by producer gas has been further stimulated in Sweden by the war-time scarcity of liquid fuels. The chief requirements for the successful use of such vehicles are: (i) The vehicle and its motor must be of a suitable character and the driver must understand his machine. (ii) Long-distance work is more economical than short, interrupted trips. (iii) The fuel must be of good quality. Charcoal used as a source of producer gas must be well carbonized, of the proper size for the particular generator employed, and free from breeze and foreign matter, especially sand. Its moisture content should be between 10 and 15 per cent. Since the power obtainable from charcoal is roughly proportional to its specific gravity, hardwood charcoal is preferred to that made from coniferous wood. A matter that still needs much attention is the establishment of a regular service for distributing charcoal to the consumers.

33.38 : 07.7 (485). Lothigius, W. Trollebo-ugnen. **[The 'Trollebo' charcoal kiln.]** *Skogen* 26, 1939 (426–7). [Sw.]

Details are given of the cost of establishment of the 'Trollebo' charcoal kiln, a stationary installation with a sheet-iron roof and walls built of local rock faced with building stone.

33.38 : 07.7 (485). Preliminärt om träkolskrossar. **[Preliminary note on charcoal crushers.]** *Skogsägaren* 15, 1939 (302–3). [Sw.]

Details of the 'Fräkentorp' crushing machine, produced by the Nya Sveaverken, Eskilstuna, Sweden.

33.38 (485). Träkolsframställning i Sparreholms ugnar. **[Manufacture of charcoal in 'Sparreholm' kilns.]** *Skogen* 26, 1939 (382–3). [Sw.]

Details of operation and operating costs during the period 1935–8. The 'Sparreholm' kiln is a simple, permanent kiln built of red brick, with a capacity of 26 cu. m. The average yield of charcoal is 58·8 per cent. of the volume of wood burnt.

33.38 (485). Wallman, P. H. Om kolning i kristider. **[Charcoal manufacture in times of crisis.]** *Skogen* 26, 1939 (420–1). [Sw.]

The author reviews the advantages of pile and kiln burning. In general, pile burning will remain the most economical method in most cases. The statement that pile burning gives a lower yield of charcoal is regarded as unfounded, except for cases where the burning is unskilfully performed.

33.38 (56.43). Danks, F. S. **Charcoal.** *Tech. Pamphl. For. Dep. Cyprus* No. 4. 1939. pp. 6.

Two methods of charcoal manufacture are described briefly, the tumulus or bee-hive method, and the portable iron kiln method. In the first of these two methods the stacked wood is covered with grass or leaves and a layer of finely sieved earth, and in a period of 9 to 14

days an impure charcoal is produced, which is 13 to 18 per cent., by weight, of the wood burned. The iron kiln produces a clean, hard, dry, and standard product in 80 to 96 hours, which is 25 to 30 per cent. by weight of the wood burned.

33.38 : 34.26 (66–7). AUBRÉVILLE, A. Les ressources immenses de l'Afrique Occidentale française en carburants végétaux. [**The vast resources of French West Africa in vegetable fuels.**] *Act. et C.R. Ass. Colon.-Sci.* 15 (171), 1939 (117–24). [F.]

The possibilities of utilizing (1) vegetable oils, (2) alcohol from the distillation of agricultural products and of wood, and (3) wood and charcoal.

33.38 (944). VINCENT, R. S. **Charcoal for producer gas. N.S.W. State Government's developmental plan.** *Aust. Timb. J.* 5, 1939 (620–3, 660).

33.38. Le problème du gaz des forêts dans l'Empire Français. [**The problem of producer gas in the French Empire.**] *Rev. int. Bois* 6, 1939 (256–67). [F.]

Producer gas is being employed on an increasing scale in the French Empire. In France, over 10,000 vehicles were run on wood or charcoal (the latter being preferred) during 1938. In the colonies, a very important problem is to create supplies of properly burnt charcoal free from tarry substances. In Madagascar and Indo-China only few modifications need be introduced into the native practice of charcoal burning to obtain the right type of fuel for generators. In the Sudan, the Forest Service is examining possibilities of establishing refuelling stations along the main roads to supply the charcoal that is produced in metallic kilns. In the Cameroons, it is proposed to set up a factory for the manufacture of charcoal briquettes.

33.4. *Converted Structural Timber*

33.4 : 38 (62.4). SMITH, J., and PETRIE, A. M. **Native housing in relation to forestry in the Anglo-Egyptian Sudan, with details of types of houses for which local sawn timber output has been standardized.** *Inst. Pap.* No. 20. 1939. pp. 12.

33.4. JOHNSON, R. P. A., and DAVIS, E. M. **Use and abuse of wood in house construction.** *Misc. Publ. U.S. Dep. Agric.* No. 358. 1939. pp. 24. [Forest Products Laboratory, Madison, Wis.]

33.5. *Roughly Converted Wood*

33.51. Pitprops and Sleepers

33.51 : 95.3 (54). INDIA. **Report and appendices. Sleeper Pool Committee.** 1937–8. Govt. of India Press, New Delhi. 1939. pp. 53.

33.51 : 33.0 (68.9). DUFF, C. E. **Timber for copper mines: a problem in Northern Rhodesia.** *Emp. For. J.* 18, 1939 (212–20).

The Copper Belt of Northern Rhodesia extends about 100 miles along the southern border of the Belgian Congo at 13° South latitude. Elevation is 4,000 ft. and annual rainfall 40 to 50 in. during 6 months. Temperatures range from light frost to 100° F. in the shade. Mining is the only industry and the only market for timber. The vegetation is tropical savanna forest, 30 to 80 ft. high and largely dominated by Caesalpiniaceae. There are two species of *Isoberlinia* and five of *Brachystegia*, and an irregular lower storey, mainly evergreen, grows on the better soils. Native shifting cultivation and fire have been effective in changing the character of the vegetation and soil over a large part of this region. Natural regeneration is fairly easy both by coppice and seeding. Mature trees reach a diameter of about 15 in. and the rotation for mining timbers and sleepers is thought to be about 60 years.

It is estimated that the mining industry will require 500 square miles of the best woodland under permanent management. Owing to transportation difficulties the economic hauling distance from forest to mine is within 10 miles. As the future value of the forest depends on the future development of the mines, the problems of forest management are directly concerned with this development.

33.6. *Packing*

33.6 : 01. **List of publications on boxing and crating.** Forest Products Laboratory, Madison, Wisconsin. 1939. pp. 12.

34. MINOR FOREST PRODUCTS AND THEIR UTILIZATION

34.2. *Vegetable Products*

34.21 : 97.2 (54.7). DALLEY, R. P. **Rotational grazing in the Bombay forests.** *Indian For.* 65, 1939 (537–43).

A discussion of proposals included in E. A. Garland's revised working plan for the West Khadesh Division.

34.26 (47.3). Bukshtynov, A. D., and Andreev, N. A. **The gutta-percha content of *Euonymus verrucosa*.** *Lesnoe Khozyaystvo, Moscow* 1939 (10), (38–41). [R.]

Report on investigations in the Moscow, Ryazan, and Tula regions. The gutta-percha content appeared to be influenced by site conditions. It tended to increase slightly with the age of the shrubs and varied to some extent in the course of the vegetation period, being lowest at the beginning and end, and highest in July.

34.26 : 12.2. Scheuble, R. Merkwürdiges von den Kiefernterpentinölen. **[Noteworthy facts on the turpentine oils of Pines.]** *Cbl. gesamte Forstw.* 65, 1939 (245–58). [G.]

Preliminary research on the constancy of composition of turpentine oils from *P. nigra* and *P. sylvestris* in the Lower Danube region, with special reference to optical rotation (capacity for rotating the plane of vibration of rectilinearly polarized light). The variation of optical rotation was much smaller for turpentine from individual trees of *P. nigra* stands than from those of *P. sylvestris*.

34.26 : 2. Webster, C. C. **Recent progress in the cultivation of Tung Oil Trees [*Aleurites fordii & A. montana*].** *Trop. Agric., Trin.* 16, 1939 (267–71). [Department of Agriculture, Nyasaland].

Experimental plantations of *Aleurites fordii* and *A. montana* in many countries have produced disappointing results. Details of progress are given for the U.S.A., the Netherlands Indies, Indo-China, the U.S.S.R., Australia, New Zealand, India and Burma, and East Africa. In tropical countries it appears that *A. montana* is the more promising. Notes are given on seed germination, transplanting, spacing of plants and subsequent attention, and selection and vegetative propagation.

34.6. *Utilization of Milling and Logging Waste*

34.6. Jahn, E. C. **Plastics from wood wastes.** *Chem. metall. Engng.* 46, 1939 (206–7). L.S.

34.6 : 33.32. Skewes, T. J., and Benson, H. K. **Oxalic acid from sulfite waste liquor.** *Industr. Engng. Chem.* [Industr. Ed.], 31, 1939 (1133–5). P.R.

34.6 : 33.32. Keeth, G. **Burning pulp-mill waste from sulphite mill.** *Trans. Amer. Soc. mech. Engrs.* 1939 (679–83). [Marathon Paper Mills Company, Rothschild, Wis.] P.R.

An account of the Howard process for treating waste sulphite liquors, whereby the factory effluent is purified and a lignin fuel is recovered for use in the power-plant furnaces.

35. SALE AND DISPOSAL OF FOREST PRODUCTS

35. **Rules for the measurement and inspection of hardwood lumber, Cypress, veneers and thin lumber.** The National Hardwood Lumber Association, 2408 Buckingham Building, Chicago. 1939. pp. 120. P.R.

38. FOREST CONSTRUCTIONAL WORKS. FOREST ENGINEERING

38. Kaegi, H. I. **Timber bridges.** *Int. Rev. Timb. Util.* 5, 1939 (5–34).

Two main types of timber bridges, the covered and the open, are described. The development, uses, construction, and maintenance of such bridges are discussed and illustrated.

38 : 31.27. Kain, A. Studie über die Berechnung verdübelter Brückenträger. **[Study on the calculation of [stresses in] grooved-and-plugged [timber] bridge girders.]** *Cbl. gesamte Forstw.* 65, 1939 (265–81). [G.]

38 : 33.15. Wilson, T. R. C. **The glued laminated wooden arch.** *Tech. Bull. U.S. Dep. Agric.* No. 691. 1939. pp. 122. [Forest Products Laboratory, Madison, Wisconsin.]

This bulletin deals with recent research on the strength of glued laminated construction, and presents recommendations for specifications and design stresses based on the results of this work.

4. PROTECTION

4 : 24.5 : 12.12. Jakeš, E., and Hexnerová, H. Über den Einfluss der Wuchsstoffe auf Wundgewebebildung bei Obstbäumen. **[The influence of growth substances upon the formation of wound tissue in fruit trees.]** *Gartenbauwiss.* 13, 1939 (83–93). [G.] Hort. Abs. 9, 1939 (200).

Wounds on various fruit trees treated with

growth substances healed more rapidly than similar untreated wounds. It is suggested that the use of growth substances may be extended in horticultural practice to the healing of tree wounds in general.

42. PROTECTION AGAINST INJURIES FROM INORGANIC AGENCIES

42.2. *Temperature influences*

42.2 : 21.2. SHIRLEY, H. L., and MEULI, L. J. **Influence of foliage sprays on drought resistance of conifers.** *Plant Physiol.* 13, 1938 (399–406). [Lake States Forest Exp. Sta.] O.B.D.

Four different foliage sprays, designed to give protection against excessive transpiration, were tested in laboratory and field experiments on *Pinus resinosa*, *P. strobus*, and *Picea glauca*. The sprays sometimes had an injurious effect, and in no case was there any significant increase in the drought resistance of the conifers.

42.3. *Precipitations and their effects*

42.3 : 11.6 : 96 (52). HIRATA, T. **On the devastations of mountains in Japan.** Dept. of Forestry, Ministry of Agriculture & Forestry, Tokyo. 1939. pp. 26.

Landslides, many of which are caused by heavy rains or earthquakes, land creep, and surface erosion, are specially frequent in deforested areas. *Cryptomeria japonica* plantations offer far less protection than broadleaved virgin forests, and Bamboos are only slightly superior to *Cryptomeria*. On the other hand, mountain slopes under *Pinus densiflora* are fairly stable as a result of the deep rooting habit of this species.

42.3 : 11.6 (54.5). CHOPRA, R. S. **Counter-erosion works in Sauj Kas.** *Indian For.* 65, 1939 (730–3).

Work so far done includes gully plugging by means of stone 'bunds' and the use of earth 'bunds' lined with sand-bags for stream training. Kana grass (*Saccharum munja*) and Marwar (*Vitex negundo*) are planted on these earth 'bunds'.

42.3 : 11.6 (54.5). GORRIE, R. M. **Some problems in soil erosion control.** *Emp. For. J.* 18, 1939 (229–34).

A discussion of experience in the Punjab with reference to plough land, waste land, and village forests.

42.3 : 96 (73). MUNNS, E. N., PRESTON, J. F., and SIMS, I. H. **Forests for erosion control.** *U.S. Dep. Agric. Soils Yearbook Separate* No. 1640, 1939. pp. 609–14. U.S. Govt. Printing Office, Washington, D.C.

It is the litter layer that is the essential part of the forest in controlling water run-off and erosion. The function of the litter is discussed and a number of examples are given of efficiency of forest cover as soil protection. Topographic and soil conditions that are usually best protected by forest vegetation include steep slopes, gully walls, sterile subsoil following sheet erosion—providing that trees with low nutritional demands are used—and land permanently released from agriculture and in danger of erosion. To be fully efficient, these forests must be protected from all adverse conditions. A brief survey is given of the present need for reforestation in the United States.

42.3 : 11.46 (78). HOOVER, M. M. **Native and adapted grasses for conservation of soil and moisture in the Great Plains and Western States.** *Fmrs' Bull. U.S. Dep. Agric.* No. 1812. 1939. pp. 43.

42.3 (78.9). DEPPA, J. W. **Cutting and use of brush in erosion control.** *Soil Conserv.* 5. 1939 (83–4, 86, 92).

With reference to the use of brush from the Stone Pine–Juniper forests of the south-western United States.

42.3 : 11.6. NICHOLS, M. L., and CHAMBERS, T. B. **Mechanical measures of erosion control.** *U.S. Dep. Agric. Soils Yearbook Separate* No. 1643, 1939. pp. 646–65. U.S. Govt. Printing Office, Washington, D.C.

42.3 : 11.6. UHLAND, R. E. **Quantitative basis for evaluating effectiveness and application of soil conservation practices.** *Soil Conserv.* 5, 1939 (152–6).

43. FOREST FIRES

43 (52). HIRATA, T. **Forest fires in Japan.** Dept. of Forestry, Ministry of Agriculture & Forestry, Tokyo. 1939. pp. 21.

Statistics, season of occurrence, and causes of forest fires; the resistance of various Japanese tree species to fire; and an outline of the history of forest fire control. The principle cause of fire is the burning of 'hara'—land covered with shrubs and grasses. The experimental work of some Japanese investigators is reviewed.

43 (73). HEADLEY, R. **Lessons from larger fires of 1938.** *Fire Control Notes* 3 (4), 1939 (30–45).

Collection of brief reports from various parts of U.S.A.

43 : 01. **Glossary of terms used in forest fire control.** U.S.D.A. Forest Service, Washington, D.C. 1939. pp. 24.

43.1. *Protective Measures*

43.1 (73). MORRIS, W. G. **Coordinating plans for fire protection facilities.** *J. For.* 37, 1939 (861–5). [Pacific Northwest Forest & Range Exp. Sta.]

A method of correlating detection, transportation, and the placing of fire fighters so as to have the combination of facilities giving the most efficient protection. Various combinations of these factors are analysed for local conditions on the basis of cost and the strength of attack required to corral a fire by 10 a.m. on the day following discovery. Information essential in determining this last factor is (1) probable size of fire on discovery, (2) rate of perimeter increase, (3) time between discovery and arrival of suppression crew, and (4) rate of fire-line construction.

43.1 : 11.2(73). **Fire danger rating methods. Region 5.** *RS-CAL. Pf-1. Fire Danger Rating.* U.S. Department of Agriculture, Washington, D.C. 1939. pp. 14. [Regional Fire Danger Rating Committee.]

The collection of relevant data on weather conditions and other factors that may affect forest fire behaviour, and their analysis and application, are discussed in detail.

43.1 (74.75). JEMISON, G. M. **The measurement of forest fire danger in the eastern United States and its application in fire control.** *Tech. Note Appalachian For. Exp. Sta.* No. 35. 1939. pp. 43.

This note 'describes a method of measuring forest fire danger and expressing it in numerical classes having definite meaning and calling for definite action'. Details are given of a fire danger meter, and other instruments for measuring moisture and weather conditions are described, together with information on the operation of the whole system.

43.1 : 11 (74 : 75). JEMISON, G. M. **The influence of locality, season, and time of day on visibility distance.** *Tech. Note Appalachian For. Exp. Sta.* No. 36. 1939. pp. 4.

43.1 : 61 (77.4). MOESSNER, K. E. **Seen-area mapping—an improved technique.** *Fire Control Notes* 3 (4), 1939 (18–25).

A technique of preparing and using seen-area maps is described. The seen area is any portion of a 10-mile circle visible to the lookout and may consist of tree tops, low shrubs, or ground cover. Any area hidden from the lookout below his line of sight is technically unseen. The technique has been tried out on the Upper Michigan National Forest with accurate and consistent results. Carefully prepared seen-area maps may prove a valuable aid in fire detection for many regions.

43.1. KIRKHAM, D. P. **Harney portable field lights.** *Fire Control Notes* 3 (3), 1939 (35–8).

A reconditioned truck headlight, battery operated, for camp lighting.

43.1. LEMBCKE, L. W. **Hose-pipe line friction-loss chart.** *Fire Control Notes* 3 (3), 1939 (31–4).

43.1. TRUAX, T. R. **The use of chemicals in forest fire control.** Forest Products Laboratory, Madison, Wisconsin. 1939. pp. 12.

Where there is an abundance of available water it is not considered worth while to use chemicals in fire control. However, where water is scarce or difficult to reach, the use of a chemical solution, particularly in the early stages of attack, may be the means of controlling the fire. Of the various chemicals and foams tested, monammonium phosphate solution appears the most satisfactory. Some of the factors that will determine the superiority of a given chemical and concentration of solution over water are (*a*) the rate of application in relation to the size and severity of the fire, (*b*) the wind velocity, and (*c*) the kind and arrangement of fuel.

43.1 : 07.7. DAVIS, J. J. **Recent developments in the construction of tank truck fire apparatus.** *J. For.* 37, 1939 (924–9).

Specifications of truck chassis and body and results of Underwriters' tests of a combination pumper and booster tank truck of 600 gallons capacity, to be used for both forest and agricultural property fire fighting.

43.1 : 07.7. SEDGEWICK, K. G., and MACDONALD, K. M. **Hose-scrubbing machine.** *Fire Control Notes* 3 (4), 1939 (27–9).

A new invention described.

43.1 : 07.7. WENTWORTH, P. M. **Retracting strings for fire dispatchers' maps.** *Fire Control Notes* 3 (3), 1939 (22–4).

Instructions for providing fire location maps with retractable strings for the projection of bearings.

43.1 : 61. CROUCH, J. C. **Recording pumper data on a topographic map.** *Fire Control Notes* 3 (3), 1939 (18–19).

43.3. *Fire damage*

43.3. MATTHEWS, D. N. **Fire hazard on slash-burned versus unburned cut-over lands.** *For. Res. Notes Pacific Northwest For. Exp. Sta.* No. 27. 1939. pp. 2.

Values for the rate of fire spread in number of chains of perimeter per hour are multiplied by values for the resistance of fire to control, as expressed by the number of men required to control one chain of perimeter, and the product is plotted over 'number of years since cutting' for both slash-burned and unburned cut-over lands. The curves indicate a big difference in the fire-control problem on the two types of land for the first few years after cutting, this difference diminishing rapidly after 10 years.

44. PROTECTION AGAINST DAMAGE BY HARMFUL PLANTS

44.3. *Fungi*

44.3 : 12.12 : 12.2 (489). MØLLER, C. M. Nye danske Undersøgelser over Rodfordærveren. [**Fresh investigations in Denmark on *Fomes* (*Polyporus*) *annosus*.**] *Dansk Skovforen. Tidsskr.* 1939 (10), (433–54). [Da.]

Some details of a paper by Jørgensen, Lund, and Treschow [*For. Abs.* 1 (188–9)] are criticized. Møller's chief objections are: (i) A closer connexion than that admitted by the authors may exist between *Fomes* attack and soil type. (ii) Data on the influence of previous soil cultivation upon *Fomes* attack might be a great deal fuller. (iii) The beneficial effect of heavy thinnings is open to doubt, being founded only on opinion. (iv) Infection through side roots probably occurs more often than suggested. The net result of the writers' inoculations shows simply that infection cannot normally take place through young living wood, whereas older, partly or wholly inactive wood is readily infected; the ruling factor in attack would seem to be the death of, or the presence of wounds on the roots, which would enable the fungus to enter the inactive parts. Further work is needed to determine the course of infection in different species and localities at different ages: research on the water content and proportion of living cells in the roots previous to infection is also desirable. (v) A nurse crop of Birch or Alder may be insufficient to reduce the risk of infection, as the mycelium of *Fomes* can persist for years in dead roots. (vi) The evidence that seedlings are less susceptible than planted stock is not conclusive. (vii) The recommended method of planting is based on the theory of the prevalence of infection through the tap root, which may be an overstatement. (viii) Wide spacing of stock to avoid root competition may be ineffective. Møller's opinion is that the minimum diameter of side roots, below which infection does not occur, is quite high: if so, the death of small roots through root competition would give no risk of infection.

44.3 : 12.12 : 12.2 (73). MARTIN, J. F. **Eradication of the cultivated Black Currant in White Pine regions.** *Leafl. U.S. Dep. Agric.* No. 175. Supt. of Documents, Washington, D.C. 1939. pp. 8.

The cultivated European Black Currant (*Ribes nigrum*) is an alternate host for White Pine blister rust (*Cronartium ribicola*); this currant is highly susceptible to the disease, and is often responsible for setting up new centres of infection. Possession and growth of this plant is forbidden by statute in many states of the U.S.A., and within certain regions the interstate movement of the plant or any part thereof is prohibited by Federal quarantine. The removal of all Currant and Gooseberry plants within 900 ft. of White Pine trees is usually adequate protection against infection.

44.3 : 12.2 (73). **Status of White Pine blister rust control on January 1, 1939.** *E–471.* U.S.D.A. Bureau of Entomology and Plant Quarantine, Washington, D.C. 1939. pp. 12.

44.3 : 45.3 : 12.12 (74.7). MCINTYRE, H. L. **Report on forest pest problems in New**

York. *J. For.* 37, 1939 (879–83). [New York Department of Conservation.]

The gypsy moth (*Porthetria dispar*), White Pine blister rust (caused by *Cronartium ribicola*), and White Pine weevil (*Pissodes strobi*) are the three most serious forest pests in New York. It is concluded that age and density are very important factors in relation to insect resistance or susceptibility, the limiting conditions varying with insect species. Other forest pests reported on are the Fir bark louse (*Adelges piceae*), the European Spruce sawfly (*Diprion polytomum*), the Eastern Spruce bark beetle (*Dendroctonus piceaperda*), the Spittle bug (*Aphrophora parallela*), sawflies (*Tenthredinidae*), and the European Pine-shoot moth (*Rhyacionia buoliana*).

44.3 : 12.12 : 12.2. Davis, W. C., and Latham, D. H. **Cedar blight on wilding and forest tree nursery stock.** *Phytopathology* 29, 1939 (991–2). [Bureau of Plant Industry, U.S.D.A.]

Considerable loss of nursery stock of *Juniperus virginiana* in the central and eastern United States is caused by *Phomopsis juniperovora*. This fungus was observed on wilding Red Cedar seedlings in natural stands in Virginia, North Carolina, and Tennessee during 1937 and 1938, and was isolated from diseased Red Cedar nursery stock in 1938. While applications of ammonium sulphate and 4–10–4 commercial fertilizer stimulated the early growth of transplants, by the end of the growing season the loss of transplants due to Cedar blight was nearly twice as great on unfertilized plots. Spraying with Bordeaux and roguing to produce blight-free stock cost 40 cents per 1,000 seedlings.

44.3 : 12.12 : 12.2. Swanson, H. E. **Blister rust control in the Inland Empire.** *J. For.* 37, 1939 (849–52). [U.S. Bureau of Entomology and Plant Quarantine.]

Blister rust infection of White Pine was first found in this region in 1927 and since then survey figures indicate 2,710,129 acres of White Pine that are valuable enough to justify cost of protection.

Eradication of *Ribes* is mainly by hand pulling or grubbing supplemented by the application of about 2 ounces of dry mixture of borax and sodium chlorate to the exposed remains of the root that cannot be removed by the normal method. On alluvial bottom land where *Ribes petiolare* and *R. inerme* grow in great numbers, the first of these species may be successfully destroyed by the application of sodium chlorate from power and portable knapsack sprays. Dense concentrations of *R. inerme* are removed by mechanical means, either by the use of a bulldozer or by hand slashing. Areas cleared in this way are usually seeded to grass. The number of times an area has to be treated before the *Ribes* are permanently eradicated depends largely on ecological conditions, and for this reason the region to be treated should first be divided into ecological types relative to conditions favourable or unfavourable to *Ribes* survival. Up to the present time a permanent control has been established by a single working on 52 per cent. of the area covered.

44.3 : 12.12. *Tree Pest Leafl., Boston.* Nos. 21, 26, 28, 32, 35, and 38. 1938–9.

Each of these leaflets gives a brief outline of the history and distribution, hosts, symptoms, cause, life-history, and control of a forest tree disease. Those dealt with are (21) the shoestring root rot of conifers and hardwoods (*Armillaria mellea* (Vahl.) Quel.), (26) White Pine blister rust (causal fungus *Cronartium ribicola* Fischer), (28) European Larch canker (*Dasyscypha willkommii* (Hart.) Rehm), (32) the Strumella disease of hardwoods (*Strumella coryneoidea* Sacc. & Wint.), (35) Willow scab (*Fusicladium saliciperdum* (All. et Tub.) Lind.), and (38) spongy white rot of hardwoods (*Fomes connatus* (Weimann) Gillet).

44.3 : 45.3. Potts, S. F., and Waterman, A. M. **Spraying and dusting to control insects and diseases.** *Tree Pest Leafl., Boston.* No. 31, 1939. pp. 4.

Insecticides are of two classes:

(*a*) Stomach poisons for the control of chewing or leaf-eating insects and usually applied as a spray.

Active ingredient	*Water* Gals.	*Sticker or spreading agent*
1. Lead arsenate, 2 to 5 lb.	100	1 pint of fish oil.
2. Derris or cube powder [4 per cent. rotenone], 2 to 8 lb.	100	½ gal. of fish oil.

(*b*) Contact poisons for the control of sucking insects.

Active ingredient	*Water* Gals.	*Sticker or spreading agent.*
3. Nicotine sulphate solution, 40 per cent. nicotine, 1 pint	100	3 lb. solid soap or 6 lb. liquid soap.
4. Pyrethrum powder [1 per cent. pyrethrins], 1 lb.	100	3 lb. solid soap or 6 lb. liquid soap.
5. Alcoholic pyrethrum extract [1 per cent. pyrethrins], 1 pint	100	3 lb. solid soap or 6 lb. liquid soap.
6. Derris or cube powder [4 per cent. rotenone], 1·5 lb.	100	3 lb. solid soap or 6 lb. liquid soap.
7. Oil emulsion—4 gals. [75 per cent. oil]	96	None.
8. Miscible oil—5 gals. [90 per cent. oil]	95	None.
9. Miscible 'white' oils, 1 gal.	100	None.
10. Lime sulphur [10 gals. liquid or 40 lb. dry]	90	None.
11. Lime sulphur [2·5 gals. liquid or 6–8 lb. dry]	100	None.

Most leaf diseases that may result in serious defoliation should be sprayed in the early spring and at intervals of about 10 days with No. 11 or:

12. Bordeaux-copper sulphate, 8 lb., hydrated lime, 10 lb.	100	Calcium caseinate 2 lb.
13. Bordeaux mixture powder, 16 lb.	100	Calcium caseinate 2 lb.
14. Wettable sulphurs	According to directions on the con-	[tainers
15. Sulphur dust and sulphur, 9 parts, arsenate of lead, 1 part [to be dusted on]	None	None.

45. PROTECTION AGAINST DAMAGE BY ANIMALS

45.1. *Mammals*

45.1 (485). SJÖSTRÖM, H. I älgskadefrågan. **[On the problem of damage by elks.]** *Skogen* 26, 1939 (467–8). [Sw.]

The elk has a preference for the bark and leaders of Scots Pine; group sowing of this species is suggested as a means of reducing the damage.

45.3. *Insects*

45.3 : 12.12 : 12.2 : 13.2 (42). SEN, P. **(A) On the biology and morphology of *Rhabdophaga saliciperda* Dufour (Cecidomyidae : Diptera) a common pest of Willows (*Salix fragilis*). (B) On the structures (anatomical and histological) of the full-grown larva of *Rhabdophaga saliciperda* Dufour (Cecidomyidae : Diptera).** *Zool. Jb.* (*Anat.*) 65, 1939 (1–36 and 37–62). R.A.E. A 27 (627–8).

Rhabdophaga saliciperda is widespread on species of Willow and Poplar in the British Isles, causing galls on the internodal regions of the branches and towards the base of the twigs. Infested twigs often die above the gall. The primary infestation of the trees is believed to be rendered possible by a softening of the bark through fungus attack following severe frost. Suggested control measures include the removal and burning of infested parts during the winter and the application of tar or other adhesives to trap emerging adults. A spray of nicotine sulphate is suggested as a means of killing eggs in the insect galleries.

45.3 : 12.12 : 12.2 : 13.2 (71.5–6). BALCH, R. E. **Further notes on the fall cankerworm and its control by 'solid-stream' spraying.** *Sci. Agric.* 19, 1939 (411–23). R.A.E. A 27 (662–4).

A recent outbreak of *Alsophila pometaria* Hart. on Elms in Fredericton, New Brunswick is described, and an account is given of its bionomics. The moth was very abundant in 1931–8 throughout New Brunswick and Nova Scotia but severe defoliation has been restricted to certain localities. Elms stripped of more than half their foliage produce a relatively scanty crop of leaves about a month later, the annual rings of the current and following year are reduced and leaf buds are late in flushing in the year following defoliation. When less than half the foliage is lost, the vitality of the trees is but little impaired. A healthy tree may survive defoliation for two consecutive years, but may be permanently injured by it. The spray finally evolved for use in Fredericton contained 2 lb. of pyrethrum powder and 5 lb. of lead arsenate in 100 gals. of water, about 26 gals. being applied to an average-sized tree. When applied as soon as the eggs had hatched, this

treatment resulted in almost complete mortality of the larvae.

45.3 : 12.12 (729.5). MARTORELL, L. F. **Some notes on forest entomology.** *Carib. For.* 1, 1939 (25–6). [E.e. span.] [Agricultural Exp. Sta., Río Piedras, Puerto Rico.]

The coffee-tree borer, *Apate francisca* Fabr., has seriously infested Dominican Mahogany plantations in Puerto Rico. Control was secured by pushing flexible wire into the tunnels to kill the beetles. The capá leaf-roller, *Hyblaea puera* Cramer, attacked *Petitia domingensis* seedlings and adequate control was secured by spraying with arsenate of lead. *Phostria originalis* Lederer, a web-worm, has been found defoliating *Andira inermis*. *From author's summary.*

45.3 : 07.7 : 13.2. POTTS, S. F. **Spraying woodlands with an autogiro for control of the gypsy moth.** *J. econ. Ent.* 32, 1939 (381–7). R.A.E. A 27 (645).

Experiments in 1936 in Massachusetts showed that the autogiro was preferable to an aeroplane for spraying small broken woodland areas to control *Lymantria* (*Porthetria*) *dispar* on Oak, because it could fly more slowly and turn, take off, and land in much less space. The aeroplane, with its greater speed and capacity and possible equipment for landing on water, is more suitable for large flat areas. Two types of spraying apparatus are described. Aerial spraying is better than aerial dusting because there is less drift, a heavier deposit, and better adherence of the spray, and a greater number of available working hours. Spraying is effective with a wind velocity up to 12 m.p.h., whereas dusting is unsatisfactory at a wind velocity of 5 m.p.h. Concentrated mixtures of lead or calcium arsenates with water and fish oil, sprayed from an autogiro at the rate of 5–10 U.S. gals. per acre gave satisfactory control of the moth. The arsenates were used in the proportion of 3 lb. per U.S. gal.

45.3 : 12.12. *Tree Pest Leafl., Boston.* Nos. 24, 25, 29, 34, 36, 37, 39, and 40. 1938–9.

Each of these leaflets gives a brief outline of the history and distribution, host trees, symptoms and injury, life history, and control of an insect that attacks some species of tree. Those dealt with are (24) the Pine spittle bug (*Aphrophora parallela* Say), (25) the gypsy moth (*Porthetria dispar* L.), (29) cankerworms (*Alsophila pometaria* Harris, *Paleacrita vernata* Peek, and *Rachela bruceata* Hulst.), (34) the European Spruce sawfly (*Diprion polytomum* Hartig), (36) the imported Willow leaf beetle (*Plagiodera versicolora* Laich.), (37) the Spruce budworm (*Cacoecia fumiferana* Clem.), (39) the brown-tail moth (*Nygmia phoerrhoea* Don.), and (40) forest and shade tree aphids (*Aphiidae*).

45.3 : 12.12 : 12.2 : 13.2. VOGT, K. Der Kiefernknospentriebwickler *Evetria buoliana* [Schiffermiller]. [**The Pine-shoot tortrix, *E. buoliana***]. *Z. Forst- u. Jagdw.* 71, 1939 (527–52). [G.]

45.3 : 13 : 12.12 (79.5 : 79.7). **Forest insect conditions in Oregon and Washington 1933–1938.** Bureau of Entomology and Plant Quarantine, U.S. Department of Agriculture, Washington, D.C. 1939. pp. 60.

45.3 : 13.1 : 12.2 : 13.2. ERLER, E. Beobachtungen zur Ökologie und Bekämpfung des Eichenwicklers [*Tortrix viridana* L.] in Westfalen. [**Notes on the ecology and control of *Tortrix viridana* in Westphalia.**] *Anz. Schädlingsk.* 15, 1939 (85–93, 105–8). [G.]

Isolated Oak trees within a Beech stand were as seriously attacked as pure Oak woods. Spraying with 'Detal' (a dinitrocresol compound) during the 2nd to 3rd larval stage gave satisfactory results.

45.3 : 13.1 : 12.12. KOZŁOWSKI, A., and CHACHAROWSKA, H. **On the Pine procession moth, *Cnethocampa pinivora*, in the Hel Peninsula and its biological control by some spiders.** *Las Polski* 19, 1939 (49–59). [Pol.] L.S.

Cnethocampa pinivora is practically unknown in virgin forests and in mixed woods generally, where it is kept down effectively by numerous natural enemies, especially spiders.

45.3 : 13.2. AMBROS, W. Vorsichts- und Schutzmassnahmen gegen Nonnenkalamitäten mit besonderer Berücksichtigung der Bestandesleimung. [**Precautionary and protective measures against devastation by the nun moth, with particular reference to the banding of woods.**] *Cbl. gesamte Forstw.* 65, 1939 (238–42, 258–62). [G.]

45.3 : 13.2. HOFMANN, C., and DAUBERSCHMIDT, K. Freilandversuche mit einem neuen Berührungsgift gegen die Nonne [*Lymantria monacha* L.]. [**Field experiments with a new contact poison for the nun moth, *L. monacha*.**] *Forstwiss. Cbl.* 61, 1939 (605–

16). [G.] [Institut für angewandte Zoologie der Bayer. Forstlichen Versuchsanstalt München.]

Aerial spraying tests with 'Nemotan' or '2172', a new contact poison manufactured by I. G. Farbenindustrie, showed it to be as effective as 'Detal', and although somewhat slower in action, it has the advantages of being harmless to warm-blooded animals and of not scalding the early shoots of Spruce.

45.3 : 13.2. McDaniel, E. I. **Controlling shield scales of deciduous trees.** *Ext. Bull. Mich. St. Coll.* No. 194. 1939. pp. 15.

The shield scales that are most destructive in Michigan are the San Jose Scale (*Aspidiotus perniciosus*) on Ash, Elm, Birch, Poplar, Linden and some other deciduous trees, and the Oyster-shell Scale (*Lepidosaphes ulmi*), of which there are three races, one common to some fruit trees, one on Birch and Poplar, and the third on Poplar, Maple, Birch, Beech, Willow, Ash, and Dogwood. These two scales are described and control measures are given in detail for them and for Scurvy Scales (*Chionaspis* spp.) that infest trees and shrubs in Michigan.

45.3 : 13.2. Müller, F. P. Nachwirkungen des Berührungsstäubemittels 'Lipan' auf die bei der Begiftung überlebenden Kiefernspanner. **[Residual effects of the 'Lipan' contact dust insecticide on Pine looper moths [*Bupalus piniarius* L.] surviving poison dusting.]** *Forstwiss. Cbl.* 61, 1939 (538–44). [G.]

45.3 : 13.2. Thielmann, K. Beiträge zur Maikäferbekämpfung im Walde unter besonderer Berücksichtigung des Bienwaldes [Pfalz]. **[Notes on cockchafer control in the forest, with particular reference to the Bienwald [Palatinate].]** *Forstwiss. Cbl.* 61, 1939 (562–80, 599–600). [G.]

Catching is still the most effective and cheapest method of control. Spraying with 'Detal' (a dinitrocresol compound) is recommended as a supplementary method for stands where catching is not practicable.

46. PROTECTION AGAINST DAMAGE BY MAN

46 : 11.46. Thompson, A. R. **Grade change protection for valuable trees.** *J. For.* 37, 1939 (837–45). [U.S. National Park Service.]

Various methods for protecting the normal balance of air, water and other sub-surface relationships of the tree from the effects of raising and lowering grades in road construction. The main type of treatment prescribes the removal of all vegetation and organic debris from the ground surface near the tree, the cultivation of the soil, and the construction of a dry well of rock around the tree, the rock extending to the periphery of the crown at a uniform level below the grade. A system of porous tiles is placed under the rock for drainage purposes.

5. MENSURATION. INCREMENT. YIELD

51. INSTRUMENTS. MEASURES AND WEIGHTS

51 : 52 : 37. Pratt, R. W. **Calculating the weight of logs by scaling stick.** *Timberman* 40 (11), 1939 (22–3).

A discussion of the magnitude and significance of the errors involved.

52.1–2. *Thickness and Diameter. Height and Length*

52.1–2 : 12.2. Gevorkiantz, S. R. **Taper table for Jack Pine [*Pinus banksiana*].** *Tech. Note Lake States For. Exp. Sta.* No. 155. 1939. p. 1.

52.4. *Volume. Volume Tables*

52.4 : 12.2 (54.5). Chopra, R. S. **Preliminary volume tables for Bhan [*Populus euphratica* Oliv.].** *Punjab For. Rec.* 1 (6), 1939. pp. 9.

52.4 (75.6). Barrett, L. I. **Recent volume tables for some Southern Appalachian species.** *Tech. Note Appalachian For. Exp. Sta.* No. 19. 1936. pp. 49.

Tables are included for the following species, the site classes being shown in brackets: Chestnut Oak (II, III), White Oak (II, III), Northern Red Oak (II), Black Oak (II), Yellow Poplar (I, II), Red Maple (II), Basswood (I, II), Shortleaf Pine (II (2), III (2)), Virginia Pine (II), Chestnut (I, II), Sugar Maple (I), White Pine (I), Scarlet Oak (III), White Ash (combined), and Black Birch (combined).

52.4 : 57 : 12.2 ; 33.32 (75). MacKinney, A. L., and Chaiken, L. E. **Volume, yield, and**

growth of Loblolly Pine in the Mid-Atlantic Coastal Region. *Tech. Note Appalachian For. Exp. Sta.* No. 33. 1939. pp. 30.

Preliminary information on pulp-timber sizes.

52.4 (79.1). LEXEN, B., and PETERSON, G. **Total height volume table for White Fir.** *Res. Note Southwestern For. & Range Exp. Sta.* No. 54. 1939. pp. 2.

52.4 (79.1). LEXEN, B., and PETERSON, G. **Merchantable height volume table for Apache Pine.** *Res. Note Southwestern For. & Range Exp. Sta.* No. 55. 1939. pp. 2.

52.4 (79.1). LEXEN, B., and PETERSON, G. **Merchantable height volume table for Arizona Pine.** *Res. Note Southwestern For. & Range Exp. Sta.* No. 56. 1939. pp. 2.

52.4. LEXEN, B., and PETERSON, G. **Merchantable height volume table for Chihuahua Pine.** *Res. Note Southwestern For. & Range Exp. Sta.* No. 57. 1939. pp. 2.

52.4. PETERSON, G. **Total height volume table for the southwestern White Pines. —*Pinus strobiformis* & *P. flexilis*.** *Res. Note Southwestern For. & Range Exp. Sta.* No. 53. 1939. pp. 2.

52.4 : 01. NICKERSON, D. E. **A method for preparing local volume tables.** *For. Chron.* 15, 1939 (228–32). [Dominion Forest Service.]

Based on the measurements of thirty trees, selected at random with fairly even representation of diameter classes. The field measurements include total height, diameter at breast height outside and inside bark, and diameter inside bark at each tenth height above breast height. Compilation included the development of curves to show: (1) the relation of double bark thickness in inches and D.B.H.O.B. in inches, (2) the relation of D.I.B. at each tenth height as per cent. of D.B.H.I.B. and height in $\frac{1}{10}$ths, above B.H., (3) the relation of total height in feet and D.B.H.O.B. in inches, (4) the average form of the trees in each D.B.H.O.B. class based on the relation between the height from the ground in feet and the D.I.B. in inches, (5) final volumes, the curves for which will vary with units of measurement and standards of utilization.

52.4 : 12.2. SCHNUR, G. L. **Volume tables for Loblolly Pine [*Pinus taeda* L.].** *Tech. Note Allegheny For. Exp. Sta.* No. 25. 1939. pp. 3.

56. INCREMENT. DIAMETER, HEIGHT, AND VOLUME INCREMENT

56 : 12.2 (43.1–5). ZIMMERLE, H. Zuwachsuntersuchungen bei der Fichte und Weisstanne im Gräfl. v. Pückler und Limpurg'schen Forstbezirk Gaildorf. [**Investigations of increment in Spruce and Silver Fir in the forest district of Gaildorf.**] *Allg. Forst- u. Jagdztg.* 115, 1939 (305–18, 323–31). [G.]

Complete confirmation of results obtained by the author in previous investigations in the Härtsfeldhausen district [cf. *For. Abs.* 1 (40)].

56 : 51. LUMSDEN, G. Q., and WHYLAND, W. P. **A pocket increment core slicer.** *J. For.* 37, 1939 (900–1).

57. RATE OF GROWTH. YIELD. INCREMENT AND YIELD TABLES

57 : 23.23 : 23.25 : 12.2 (47.2–6). DAVIDOV, M. V. **The productivity of Black Alder plantations created by sowing.** *Lesnoe Khozyaystvo, Moscow* 1939 (11), (30–4). [R.]

The standing volume of 10–16 m. high Black Alder plantations created by sowing is 10–20 per cent. higher than that of comparable stands reproduced from the stool, while in the 18–22 m. height class the volume of the latter exceeds that of the former by about 5 per cent. according to the sample plot data from the White Russian and Russian Republics, and by about 10 per cent. according to Estonian data.

57 : 12.2 (47.3). IONOV, M. I. **Weymouth Pine plantations.** *Lesnoe Khozyaystvo, Moscow* 1939 (11), (34–7). [R.]

The Weymouth Pine plantations of the Tambov-Ryazan region, now over 30 years old, show good growth and health and have almost twice as large a standing volume per unit area as comparable Scots Pine woods in the same region.

57 : 12.2 (78.3). HORNIBROOK, E. M. **Preliminary yield tables for selectively cut stands of Ponderosa Pine in the Black Hills.** *J. For.* 37, 1939 (807–12).

57 : 74 : 12.2 (91.4). LAUDENCIA, C. M. **Money yield table and price-age gradient of Ipil-ipil [*Leucaena glauca* (L.) Bth.]** *Philipp. J. For.* 2, 1939 (235–51). [Bureau of Forestry, Philippines.]

Reproduction mortality varies directly with age of stand, and the older the stand, the more

intense is the attack of *Cocotrypes philippinensis* on suppressed seedlings and sprouts. On the slope type the maximum yield of Ipil-ipil is obtained at 10 years, although it is still profitable to maintain an Ipil-ipil [coppice] plantation up to 11 years. The curves for mean annual increment and current annual increment cross at the age of 4 years.

57 : 12.2 (922). HELLINGA, G. Opstandssamenstelling van normale laaggedunde djatiplantsoenen. **[Stand table for normal Teak plantations thinned in the lower storey.]** Boschbouwproefstation, Buitenzorg. 1939. pp. 96. [Du.e.]

57. SCHUMACHER, F. X. **A new growth curve and its application to timber-yield studies.** *J. For.* 37, 1939 (819–20).

57 : 12.2. SCHAEFFER, L. Tables de production pour le Douglas. **[Yield tables for Douglas Fir.]** *Bull. Soc. for. Franche-Comté* 32, 1939 (131–45). [F.]

American, English, and Prussian tables, and yield data from Switzerland, Holland, and Belgium, are reviewed and compared with preliminary results from French permanent sample plots at Barres, St. Just-d'Avray, and Amance. The French investigations confirm to some extent the data obtained in other countries.

6. MANAGEMENT. WORKING PLANS. SURVEYS

61. SURVEYING. MAPPING. PHOTOGRAPHY

61. SALVERDA, Z. Exploratie van uit de lucht. (Rapport naar aanleiding van practijkervaringen op Nieuw-Guinea.) **[Exploration from the air. (Report based on practical experience in New Guinea).]** *Tectona* 32, 1939 (772–86). [Du.]

A general review of the usefulness and limitations of aerial reconnaissance and photographic surveys for forestry purposes in the tropics. Simple reconnaissance, especially if supplemented by photographs taken with an ordinary hand camera, can be extremely useful in simplifying and speeding up the exploration of unknown territory. Systematic mapping by aerial photography is, however, too costly and technical a procedure for ordinary purposes, though if such photographs exist, it will naturally pay to use them. Aerial reconnaissance facilitates ground surveys and greatly reduces the amount of work that has to be done, but ground work will always be necessary, even if reduced to a minimum. The paper concludes with an annotated series of photographs taken from the air with an ordinary camera in New Guinea.

61 : 07.7. BUSHNELL, T. M. **The rectification of enlargements and of map data from aerial photos by Indiana Soil Survey.** *Photogramm. Engng.* 5, 1939 (147–52). L.S.

61 : 23.6. MINCKLER, L. S. **The block-line method of plantation examination.** *J. For.* 37, 1939 (872–5). [Appalachian Forest Exp. Sta.]

The plantation is divided into 2, 3, or 4 approximately equal blocks, the boundaries of the blocks being determined by size, minor site variations, or other conditions that may affect survival; 2, 3, or 4 random sampling lines of milacre plots or staked trees are run across the planted rows for examination purposes. At least 6 random lines should be examined in plantations under 80 acres and 8 or 9 lines in larger areas. Details of field procedure are given and costs are compared for this method and the standard method of one or more rows of adjacent staked trees.

64. DESCRIPTION OF SITE. ASSESSMENT OF QUALITY

64 : 12.2 (77). KELLOGG, L. F. **Site index curves for plantation Black Walnut, Central States Region.** *Sta. Note Central States For. Exp. Sta.* No. 35. 1939. pp. 3.

64 : 12.2 (77). KELLOGG, L. F. **Site index curves for plantation Black Locust, Central States Region.** *Sta. Note Central States For. Exp. Sta.* No. 36. 1939. pp. 3.

65. DESCRIPTION OF GROWING STOCK

65 : 21.6. BURGER, H. Der Kronenaufbau gleichalteriger Nadelholzbestände. **[The crown structure of even-aged coniferous woods.]** *Mitt. schweiz. Anst. forstl. Versuchsw.* 21, 1939 (5–57). [G.g.f.]

In a 35-year-old Spruce stand at Chanéaz, canton Vaud, and in a mixed 40-year-old Spruce-Silver Fir stand at St. Gallen, the

author examined various factors characterizing crown structure, such as proportion of dominant, sub-dominant, dominated, and suppressed trees, their average total and stem heights, the total length of their crowns, the length of their 'sun' crowns (portion above greatest crown width), the area shaded by the crowns, crown volume and weight, needle weight and area, the extent to which crown volume is decreased by pruning, &c. The figures obtained were on the whole similar for both stands, and in each the sun needles were larger than shade needles.

65 : 56 : 12.2. BURGER, H. Baumkrone und Zuwachs in zwei hiebsreifen Fichtenbeständen. **[Tree crowns and increment in two mature Spruce stands.]** *Mitt. schweiz. Anst. forstl. Versuchsw.* 21, 1939 (147–76). [G.g.f.]

Detailed study of the structure of a very open, 132-year-old stand (112 trees per ha.) and of a very dense, 98-year-old stand (712 trees per ha.) gave the following results: For the same diameter, shaded area of ground and crown volume were much greater in the open than in the dense stand. In each stand, the area shaded by the crown and the crown volume increased with tree diameter, and the fresh weight of needles per cubic metre of crown volume was generally greatest for the thin trees, decreased rapidly as the diameter increased towards medium thickness, and tended to increase slightly again for the thick stems. In the dense stand, the fresh weight of needles required to produce a given annual timber volume was greatest for the suppressed and dominated trees, while in the open stand comparatively high efficiency was shown by needles of the medium diameter classes. The sum of the areas shaded by the crowns of the dense stand, per hectare, was 9,156 sq. m., the sum of the crown volumes 54,000 cu. m., the total fresh weight of the needles 30,000 kg., their total area 165,000 sq. m., and the annual timber (Derbholz) production 13·9 cu. m. The corresponding figures for the open stand were: Sum of shaded areas, 5,100 sq. m.; sum of crown volumes, 48,400 cu. m.; total fresh weight and total area of needles, 14,700 kg. and 80,800 sq. m., respectively; and annual timber production, 8·4 cu. m. Thus the amount of needles required for the production of one cubic metre of timber was 1,750 kg. and 2,100 kg. for the open and dense stand respectively. Using von Höhnel's annual transpiration figure, it is estimated that the dense stand transpired twice as much water as the open stand.

66. POSSIBILITY. YIELD REGULATION

66 : 72. PETRINI, S. Realisationsproblemen i skogsbruket. **[The problem of realization in forestry.]** *Svenska SkogsvFören. Tidskr.* 37, 1939 (388–97). [Sw.]

The fundamental problem of realization is to determine the time and rate at which the final yield should be removed in existing mature stands. An important special aspect of this problem is the treatment of untended natural stands to bring them under proper management. In such cases the classical calculation of the financial rotation is of little use to the forester, since he is not concerned with the previous costs and expenditure, but must treat each stand on its own merits. The length of the rotation cannot be worked out far in advance, but in each case the development of the stand in its later stages must fix the date of the final fellings, and research is necessary to provide data for forecasts of development as used in estimating the probable effect of different methods of extracting the final yield. An example is given of the method of calculating the financial results in a simple case of clear felling with planting as compared with successive fellings with natural regeneration. The effects of the rate of removal upon employment and national economy is also discussed.

66 (73). CHAIKEN, L. E. **The approach of Loblolly and Virginia Pine stands toward normal stocking.** *J. For.* 37, 1939 (866–71). [Appalachian Forest Exp. Sta.]

Serious errors in growth predictions may result from the use of yield tables without consideration of changes in stand stocking. A method for estimating the rate at which abnormally stocked Loblolly and Virginia Pine stands approach normality is presented, based on the observed average differences in densities of present untreated stands of different ages.

66 : 95 : 76 (74.7). CRAWSHAW, T. H., and RECKNAGEL, A. B. **Sustained yield and taxes—With comments by F. A. Silcox.** *J. For.* 37, 1939 (791–5).

Costs and returns are given for two tracts of timber that are being managed for sustained yield in the Adirondack Mountains of New York, and the data are discussed with particular reference to the present taxation policy.

66. DANNECKER. Über die Leistungskontrolle zur Leistungswirtschaft. [**Production control in forests managed for timber production.**] Division of Forest Management Research, U.S. Forest Service, *Translation*. No. 348. 1939. pp. 16. [Translated by G. Radke from original in *Dtsch. Forstwirt* Nos. 81–3, 1929.]

66. LAURIE, M. V. **Safeguarding the 'safeguarding formula'.** *Indian For.* 65, 1939 (672–8). [Forest Research Institute, Dehra Dun.]

Many forests in India are understocked in the upper diameter classes as a result of past exploitation, and the present object is to build up productivity. While Smythies' 'safeguarding formula' is effective in maintaining the yield of selection trees, it does not guarantee against general overfelling in an abnormally stocked forest. The proper working of the formula requires (*a*) a correct knowledge of the best exploitable diameter in respect of the value-increment curve, (*b*) a normal number of Class II trees in respect of age-class distribution, (*c*) accurate figures for mortality per cent. and for the average time required for a Class II tree to pass into Class I (exploitable).

As a check it is suggested that the yield should be calculated by one of the modifications of von Mantel's formula, and, if it is found that the increment of the forest as a whole is below normal, this yield figure should be arbitrarily reduced so as to allow the growing stock to be built up. This reduced yield may then be compared with that obtained by Smythies' formula, based on the predetermined most paying exploitable diameter, and the yield figure representing the smaller volume of timber should be used. Allowance should also be made in the calculated yield for trees that will not be silviculturally available at the time of cutting.

67. WORKING PLANS

67 : 97.2 (485). WENNMARK, G. Skogsvårdsplaner på hemmansskogar. [**Working plans for farm woodlands.**] *Skogen* 26, 1939 (464–6). [Sw.]

Describes a simplified form of working plan devised by the Local Forestry Board for owners of farm woodlands. The cost of such a plan may be reduced to as little as 25–50 öre per ha.

67 (54.7). KOTWAL, E. K. **Revised working plan for the Panch Mahals Forests.** Govt. Central Press, Bombay. 1939. pp. 126.

67 (54.8). BRAND, A. R. **Working plan for the Vellore East Forest Division, Madras [1936–37 to 1945–46].** Supt., Govt. Press, Madras. 1939. pp. 125.

67 (59.1). CHEIN HOE, T. **Working plan for the Allanmyo Forest Division for the period 1937–38 to 1951–52. Vol. I.** pp. 65. **Vol. II.** pp. 197. Supt., Govt. Printing and Stationery, Rangoon, Burma. 1939.

67 (59.1). KYAW KHINE, C. **Working plan for the Lower Chindwin Forest Division for the period 1937–38 to 1951–52. Vol. II.** —Chaps. VI–XIV and Appendices VIII and IX. Supt., Govt. Printing and Stationery, Rangoon, Burma. 1939. pp. 77.

67 (91). HODGSON, D. H. **Working plans in Malaya.** *Malay. Forester* 8, 1939 (149–54).

A brief review of the difficulties of forest planning in a rapidly developing country like Malaya and a discussion of the basic considerations to be observed in the formulation of forest working plans in that country. *From author's summary.*

7. ECONOMICS. VALUATION. FINANCE. PROFIT AND LOSS

72. GENERAL PROBLEMS OF PROFIT AND LOSS

72 (77.3–6). MATTHEWS, D. M. **Financial aspects of forestry in the Lake States.** *J. For.* 37, 1939 (711–16).

Using the basic cost data presented in the 'Timber Management and Financial Plans for the Goodman Working Circle' recently prepared by the U.S. Forest Service for the Goodman Lumber Company, a comparative financial forecast is made for a selective logging and a clear-cutting plan. Selective logging is shown to be much more profitable quite apart from the fact that it is more desirable silviculturally. The 'profitless point' expressed as a percentage of normal capacity operation is considerably lower in the case of selective logging. [Profitless point in percentage of capacity =

$$\left\{\frac{\text{Fixed cost}}{\text{Income}-(\text{Volume}\times\text{Variable cost per unit})}\right\}]$$

72. BEEKMAN, H. A. J. M. Theoretische beschouwingen over de beoordeling van de financieele resultaten, eventueel de ondernemerspremie, in het boschbedrijf. [**Theoretical reflections on the appraisal of the financial results and of the 'owner's premium' in forest management.**] *Ned. Boschb.-Tijdschr.* 12, 1939 (305–21, 352–70). [Du.]

74. VALUE OF THE SOIL

74 : 63. PETRINI, S. **Calculation of the value of the soil in forestry and calculation of the financial rotation of a forest stand. Two lectures on forest economics.** *Inst. Pap.* No. 21. 1939. pp. 13.

9. FOREST POLICY

9 (56.43). WATERER, R. R. **Forest policy in Cyprus.** *For. Treasures* 2, 1939 (13–17).

The forests of Cyprus are divided into Main State Forests and Minor State Forests. The former include forests in the more important catchment areas and some lowland plantations, they are under the control of the Forest Department, and are to be strictly maintained as protection forests. The Minor State Forests, under the District Administration, consist of lowland scrub forest and are to be used for whatever purpose necessary. The three original forest laws of 1879, 1881, and 1889 have been replaced by that of 1939.

90. GENERAL PRINCIPLES. OBJECTS OF MANAGEMENT

90 : 09.4 (44). MARTELLI-CHAUTARD, M. Le rôle de nos forêts coloniales dans l'économie française de guerre. [**The role of colonial forests in French war-time economy.**] *Act. et C.R. Ass. Colon.-Sci.* 15 (173), 1939 (133–7). [F.]

Only 55 per cent. of the 406,240 metric tons of timber produced in the French colonies in 1938 were bought by France. In that year, Germany imported 160,000 tons of French colonial timber. In the course of the war, France will have to absorb a higher proportion of her colonial timbers than she has done so far; at the same time, it should be possible to increase production, provided that (1) suitable transport facilities are available, (2) the colonies are not depleted of their Forest Services by mobilization, (3) no unreasonable obstacles are put in the way of private extraction, and (4) a fair price is fixed for the produce. The author also discusses possibilities of paper-pulp and of increased fuel production from colonial raw material.

90 (71.4). Programme d'action et de politique forestière pour le Québec. [**Programme of work and forest policy for Quebec.**] *La Forêt Québecoise* 1 (2, 3), 1939 (25–33, 25–39). [F.]

90. PETRINI, S. Skogsbrukets mål. [**The object of forestry.**] *Svenska SkogsvFören. Tidskr.* 37, 1939 [379–87]. [Sw.]

A general review of the objects of forestry in relation to national and private economy, with particular reference to Swedish conditions. The main conclusions are: (*a*) Forest production should be maintained at a high level, and where possible forest land should be made productive. (*b*) Special attention must be given to the production of high quality timber for export, and woodworking industries should be developed so that exports can be in as finished a form as is economically possible. (*c*) Forestry must pay as an investment.

91. BENEFICIAL EFFECTS AND ECONOMIC SIGNIFICANCE

91 : 97.1 (54.3). SAGREIYA, K. P. **Forests and rural welfare. Central Provinces & Berar.** *Indian For.* 65, 1939 (738–42).

92. FOREST LAW

92 (68.9). CLEMENTS, J. B. **Restriction and control over cutting on native lands.** *Sylva* 20, 1939–40 (11–12).

In Nyasaland certain restrictions over the cutting of trees on native lands are laid down in the Forest Rules. These restrictions prohibit the cutting of certain species, limit the uses for which other species may be cut, and protect certain lands, other than State and village forests, against cutting and cultivation.

92 : 45.3 (71). CANADA. **The Pest Control Products Act** [Office Consolidation of the Agricultural Pests' Control Act, 1927, as amended in 1939]. Govt. Printer, Ottawa. 1939. pp. 13.

92–5 (72). MEYER, H. A. **Public forest regulation in Mexico.** *J. For.* 37, 1939 (856–8).

All forests, regardless of ownership, are subject to the forest law. The requirements needed to obtain a permit of exploitation vary with class of forest, ownership, and kind of exploitation. Forest taxation is based on yield rather than growing stock.

92 (729.5). U.S.A. **Compilation of State laws on forestry and certain related subjects for the State of Puerto Rico.** U.S.D.A., Forest Service, Division of State Cooperation, Washington, D.C. 1939.

92 : 94.1 (73). U.S.A. **The principal laws relating to the establishment and administration of the National Forests and to other Forest Service activities.** *Misc. Publ. U.S. Dep. Agric.* No. 135. Revised ed. Supt. of Documents, Washington, D.C. 1939. pp. 40.

92 (74.2). U.S.A. **Compilation of State laws on forestry and certain related subjects for the State of New Hampshire.** U.S.D.A., Forest Service, Division of State Cooperation, Washington, D.C. 1939.

92 (74.7). U.S.A. **Compilation of State laws on forestry and certain related subjects for the State of New York.** U.S.D.A., Forest Service, Division of State Cooperation, Washington, D.C. 1939.

92 (77.2). U.S.A. **Compilation of State laws on forestry and certain related subjects for the State of Indiana.** U.S.D.A., Forest Service, Division of State Cooperation, Washington, D.C. 1938.

92 (77.6). U.S.A. **Compilation of State laws on forestry and certain related subjects for the State of Minnesota.** U.S.D.A., Forest Service, Division of State Cooperation, Washington, D.C. 1939.

92 (91.4). NANO, J. F. **Kaingin laws and penalties in the Philippines.** *Philipp. J. For.* 2, 1939 (87–92).

94. OWNERSHIP, ACQUISITION, AND ALIENATION

94 : 97.2 (74.7). DONAHUE, R. L. **A unique forestry cooperative organization.** *J. For.* 37, 1939 (817–19).

An organization of the farmer woodlot owners on a 100,000-acre tract in Tioga County, New York. The object of the organization is to improve the yield of the woodlands, increase the income derived from them, and develop a sustained-yield management policy.

94.1 (4 : 73). U.S.A. **Community forests: their development in Europe and their possibilities in the United States.** *B—19.* U.S.D.A., Forest Service, Washington, D.C. 1939. pp. 18.

94.1 (73). U.S.A. **Community forests in the United States.** *B—26.* U.S.D.A., Forest Service, Washington, D.C. 1939. pp. 18.

94.1 : 91 (74.7). PRESCOTT, H. F. **Municipality or community forests; their importance as a source of future timber supply, for the conservation of wild life, and for recreational use.** State of New York Conservation Department, Albany, N.Y. 1939. pp. 50.

94.3 (42.1–8). ROWE, W. H. **The State and private woodlands.** *Quart. J. For.* 33, 1939 (237–43).

It is in the interest of the State that the planting, management, and marketing of private woodlands should be done efficiently, on a sound business basis, under the supervision of a competent authority, and that where necessary the owner should be compelled to place his woodlands under proper management.

94.3 (77.3–6). BANZHAF, G. **Accomplishments and probable future of private forestry in the Lake States.** *J. For.* 37, 1939 (701–4).

The author quotes examples of fairly satisfactory forest management by private companies. A report issued in 1938 by the U.S. Forest Service gave the following broad general statistics concerning the estimated area of privately owned commercial forest lands (exclusive of farms) under management in the Lake States:

Under intensive sustained-yield management, 72,000 acres.

Under extensive sustained-yield management, 28,000 acres.

Under extensive management, but not sustained yield, 631,000 acres.

96. PROTECTION FOREST. POLICY REGARDING DEFORESTATION, AFFORESTATION, AND FIXATION WORKS

96 : 97.1–2 (481). DAHL, S. Omkring skogreisingen på Vestlandet. [**On afforestation in Vestland.**] *Tidsskr. Skogbr.* 47, 1939 (339–45). [Nor.]

In Vestland 93 per cent. of the forest land is privately owned, most of the owners being farmers. The large-scale afforestation planned by the government should thus be facilitated by the existence of so many small holdings, a circumstance that reduces the task of the landowner to manageable proportions. State aid for afforestation consists of free advice, some free planting stock, and grants towards the cost of planting. The chief hindrances to rapid progress are forest grazing and common rights over forest and forest pasture. Difficulties arising from forest grazing, which is an uneconomical practice, can be overcome by establishing 'cultivated pastures' (fenced pastures systematically fertilized and grazed). Common rights are a serious obstacle since they permit destructive utilization but give no legal basis for constructive work. The only solution of this difficulty is the extinction of common rights and the division of common land between the individual right-holders. Two committees are examining the possibilities of hastening the procedure in such cases; in the meantime the initiative must come from the farmers themselves and must take the form of joint applications for the extinction of common rights.

96 : 09.4 (485). SÖDERQVIST, S. V. En ökad och förbättrad skogsproduktion är målet. [**Our aim is to increase and improve forest production.**] *Skogen* 26, 1939 (437–9). [Sw.]

The 1923–9 forest survey of Sweden shows that the area of bare productive forest land amounts to 14,666 sq. km., representing a potential annual increment of about 4 million cu. m. There is insufficient growing stock on the productive forest area itself, and the average annual cut exceeds the increment by some 12 million cu. m. It is recommended that all suitable bare land should be afforested; that the productive area should be augmented by drainage and soil improvement, particularly in southern and central Sweden, where the highest yields may be expected; and that instruction and propaganda should be intensified so that all members of the public may realize the importance of forests and forestry.

96 : 42.3 : 11.6 (54.1). AHMAD, Y. S. **Can Bengal claim compensation for her floods?** *Indian For.* 65, 1939 (678–83).

Suggestions for flood control and soil conservation include: hill cultivation on terraces, contour trenches on hill slopes, making catchment areas as reserved forests, and prohibition of indiscriminate 'Jhuming' (shifting cultivation).

96 : 11.6 (72). MARTÍNEZ, I. R. Cooperación del Departamento Forestal y de Caza y Pesca en la campaña nacional contra el paludismo. [**Cooperation of the Department of Forestry, Game & Fisheries in the national campaign against swamps.**] *Bol. Dep. For. Caz. Pesc.* 4, 1939 (111–21). [Span.]

Programme of drainage and afforestation for swampy *Anopheles*-infested regions. These are inhabited by some of the poorest population of Mexico and it is hoped that the campaign which is being started on a large scale will better their standard of living by achieving sanitation and by increasing local labour demand.

96 : 6 (92). BOON, D. A. Maatregelen ter verzekering van de productie mogelijkheden der bosschen in de Buitengewesten. [**Measures to safeguard the productive capacity of the forests of the Outer Provinces.**] *Tectona* 32, 1939 (829–46). [Du.du.e.]

The future development of logging in the Dutch East Indies, excluding Java, depends essentially upon an improvement in the productive capacity of the forests, and this improvement depends in turn upon the adoption of proper measures for regeneration. Strip planting will be preferable to planned natural regeneration in most cases, since it affords a better chance of obtaining successful regeneration over large areas at about the same cost. If strip planting is adopted, adequate nurseries and organized seed collection will be necessary. Proper working plans and intensified management will also be required in areas where regeneration is carried out.

97. RELATION OF FOREST TO AGRICULTURE, MOUNTAIN PASTURE AND INDUSTRY

97 : 09.7 (91). WATSON, J. G. **Forestry and tin mining.** *Malay. Forester* 8, 1939 (145–9).

A discussion of the present and possible future relation of forestry and tin mining in Malaya in regard to the most efficient utilization of the country's resources, and with particular reference to a recently published report by Sir Lewis Leigh Fermor, who, in 1938, investigated the present conditions and future prospects of the mining industry in Malaya.

97.1 : 09.4 (45). SALDARELLI, R. Il bosco in rapporto alle altre colture dei terreni. [**Forest in relation to other forms of land use.**] *Riv. for. ital.* 1, 1939 (413–28). [It.]

97.1 : 11.6 (74.4 : 74.6). MONTGOMERY, P. H. **Erosion and related land use conditions on the Scantic River Watershed, Connecticut–Massachusetts.** U.S.D.A., Soil Conservation Service, Washington. D.C., 1939. pp. 27.

The report of a survey of the different types and degrees of erosion and their relation to soil types, slopes, and land use. In this region the ground is frozen in winter and soil moisture is generally adequate for grass, shrubs, and trees. Erosion control measures are discussed, including retirement of certain land to pasture or woodland, rearrangement of fields, and various aspects of good soil management.

97.2 (73). **Policies and procedure for the Farm Forestry Program of the Department of Agriculture under the Cooperative Farm Forestry Act.** Office of Land Use Coordination, Soil Conservation Service, U.S.D.A., Washington, D.C. 1939. pp. 5.

97.2 (73). **Some questions and answers regarding the Cooperative Farm Forestry Program.** U.S.D.A., Soil Conservation Service, Washington, D.C. 1939. pp. 13.

98. STUDY OF THE TIMBER MARKET

98 : 09.4 (63 : 67.7). SENNI, L. Il mercato dei prodotti forestali in A.O.I. [**The forest products market in Italian East Africa.**] *Riv. for. ital.* 1, 1939 (529–32). [It.]

98.1 : 33.32 (71.1). KNAPP, F. M. **Can British Columbia meet the future requirements for pulpwood?** *For. Chron.* 15, 1939 (233–8).

Insufficient data and unknown future requirements make it difficult to estimate whether British Columbia can meet the pulpwood demand indefinitely. The present situation is summarized, information being given on the present stand of pulpwood species, pulpwood utilization, future use for pulp species, growth, and fire damage. The Coast pulpwood resources should be adequate for 25 to 65 years depending upon unpredictable demand for pulpwood and lumber. The need for managing forests for sustained yield is emphasized, the first step being to secure prompt regeneration of cut-over land together with better fire protection; this done, the mean growth possibilities will be between 2 and 3 billion board feet per annum.

98.3 : 09.4 (497.1). L'exportation des produits forestiers yougoslaves en 1938. [**Exportation of forest products from Yugoslavia in 1938.**] *Rev. int. Bois* 6, 1939 (285–309). [F.]

BOOKS

31.3 : 02.1. Hägglund, E. Holzchemie. [**Wood chemistry.**] 2nd edition. Akademische Verlagsgesellschaft m.b.H., Leipzig. 1939. pp. 397. P.R.

During the 11 years which have elapsed since the appearance of the first edition of this work enormous progress has been made both in the science of wood chemistry and in its industrial applications. On the academic side of the subject, a whole body of theory on the structure of the wood cell-wall and the crystalline structure of cellulose has grown up, while the work which has been carried out during the same period on lignins and hemicelluloses is also of first-class importance, even though at present it is somewhat indefinite in its theoretical results. In the industrial field numerous methods for production of sugar and ethyl alcohol from wood have been developed; pulping processes have been improved, and new processes have been put into operation. The present edition is greatly increased in size as a result of the discussion of these and other advances, even though the treatment of some questions is rather condensed. The general plan of the work remains as before. References to original sources of information are copious, but Russian publications, some of which contain important contributions to the subject, have generally been ignored, doubtless because of the language difficulty.

There are a few minor faults—some of them carried on from the first edition—which may be pointed out. The paragraphs dealing with α-cellulose do not appear to define this substance very clearly or to state how it is isolated or estimated. In the account of the pentosan determination (pp. 103–4) the important work of Kröber, who placed the phloroglucinol method on a sound quantitative basis, is not referred to, and there is no mention of the now widely used thiobarbituric acid method. The statement (p. 137) that the chlorine-sodium sulphite reaction is specific for lignin is incorrect. The account of the catalytic hydrogenation of lignin (pp. 183–4), a reaction which promises to be of industrial importance, recounts only the earliest work, although, to be sure, reference to an important recent paper on the subject is made later on in a footnote (p. 217). These lapses, however, are not typical of the work as a whole, which, while it does not partake of the nature of a handbook of laboratory practice, is a mine of information on the fundamental aspects of wood chemistry and gives an excellent account of the present uses of wood as a chemical raw material. It is probably the best recent general work on the subject in any language.

S. A. Bryant.

11.6 : 96 (73). Gustafson, A. F., Ries, H., Guise, C. H., and Hamilton, W. J. **Conservation in the United States.** Comstock Publishing Company, Inc., Ithaca, New York. 1939. pp. 445.

The great waste of all kinds of natural resources which accompanied the settlement and growth of the United States still continues to a very considerable extent, and, although there has been progress in conservation, it has been uneven. As plans for conservation and restoration must depend on informed public opinion, this volume has been written to present the facts in a non-technical way for students and other interested readers. The word conservation, as understood by the authors, and by an increasing number of Americans, does not mean preservation, but 'wise use, avoidance of waste, and where possible, restoration and perpetuation'.

The book is divided into four parts corresponding to four categories of resources. The separate authors for each part are all members of the faculty of Cornell University, and each is a specialist in at least the major portion of the field covered.

Part I, Conservation of Soil and Water Resources, 143 pages, is by A. F. Gustafson. The author emphasizes the importance of the soil, briefly describes its formation, and sketches the soil regions and types of utilization. Forests cover about one-third of the whole country. Soil erosion, both by water and by wind, is very serious. Nearly one-third of all the land has lost from one-quarter to three-quarters of its valuable surface soil, more than one-tenth has lost more than three-quarters of its surface soil and part of its sub-soil, and only less than one-third has suffered little or no erosion. A good deal of the eroded land in the eastern half of the country, when abandoned for farming,

reverts naturally to forest. In addition to destruction of productive land, erosion causes the rapid silting of reservoirs and the consequent irreplaceable loss of dam sites.

Part II, Conservation of Forests, Parks, and Grazing Lands, 100 pages, is by C. H. Guise. Three chapters are devoted to the forests, one to the parks, national and state, and one to the western grazing lands.

Much of the original 822 million acres of forest has been cleared for agriculture, but also many million acres have been devastated by destructive exploitation and fires so that to-day they are waste land. Of the remaining 615 million acres of forests 495 million are considered to be of commercial value. The uses of the forests are presented under five heads, namely, sources of material, watershed protection, recreation, habitats for wild life, and grazing. The principal forest regions are described very briefly with the more important trees in each, and figures are given for the different classes of ownership. Of the commercial forests, 80 per cent. are in private hands. In sketching the destructive progress of the lumber industry from east to west, the author excuses the waste on the ground that the forests seemed unlimited, and that the timber was needed for a growing nation of pioneers.

Forestry has made good progress in the national forests, which total 170 million acres, including those of Alaska, and in some states. But only 5 per cent. of the privately owned lands are managed under forestry principles, though the area so managed is increasing. A little over half of the forests of the country receive a measure of fire protection. A programme of forest conservation is recommended, consisting of five steps: (1) protection from fire, insects, and disease; (2) conservative cutting in place of the destructive methods still widely used; (3) increase in public ownership; (4) practice of forestry, intensively on 100 million acres, and extensively on 339 million acres; and (5) reforestation of that part of the denuded land and abandoned farm land that will not restock naturally, which amounts to about 70 million acres out of the 83 million acres denuded and 55 million acres of abandoned farms.

The chapter on parks gives a good brief account of the policy on which national and state parks are based, as well as of the outstanding features of some of the more important national parks, and covers also the national monuments, which are mostly smaller areas set aside for scientific or historic reasons. Some of the national parks contain large tracts of virgin forest which will be kept undisturbed, and will therefore be of the highest value to forestry and ecological research as showing how forests grow under completely natural conditions. Samples of virgin forest have also been reserved for research in the representative types in the national forests.

The western grazing lands are important in forestry because the summer range is mostly in the forested mountains which rise above the semi-arid lands and are included in the national forests. Except for the national forests on which the Forest Service has controlled the grazing by keeping it within the carrying capacity of the range, deterioration has been severe and still continues; 17·3 million head of live stock are being grazed on land with a carrying capacity for only 10·8 million head.

Part III, Conservation of Wild Life, a term much used in the United States to cover all forms of non-domesticated animals, from frogs to grizzly bears, 85 pages, is by W. J. Hamilton, Jr. The decline in the numbers of game and other animals is attributed to over-shooting and destruction of habitat. Present efforts towards restoration include closed seasons, bag limits, and game refuges. Emphasis is shifting from artificial propagation to improving the habitat conditions and getting natural restocking where possible.

Part IV, Conservation of Mineral Resources, 67 pages, is by H. Ries, and falls outside the scope of forestry.

Each chapter is followed by a list of questions for use in the classroom. There are 232 text-figures, some of them maps and charts, but most of them photographs, all well selected to illustrate the text. The frontispiece is especially noteworthy, a cartoon by 'Ding' (J. N. Darling), one of the best-known cartoonists in America and a leader in conservation, picturing the wasteful rendering of natural resources into money, leaving the country a gaping empty hole.

A short list of supplementary reading is given for each of the four parts, and there is an index. The book is well printed and attractively bound.

BARRINGTON MOORE.

97.2 : 6. GUISE, C. H. **The management of farm woodlands.** McGraw-Hill Publishing Company, Ltd., Aldwych House, London, W.C. 2. 1939. pp. 352.

There are very few large private estates in America, and farm woodlands represent that part of the original farm area which has never been cleared of trees, or cleared land which has been allowed to slip back into woodland, or, more rarely, parts of the farm which have been planted with trees. Most of the entirely deserted farms have become tax delinquent and have reverted to the state or the county.

The total area of farm woodlands is estimated at over 126 million acres, of which about a quarter is classed as saw-timber areas. The total area increases every year as more and more land falls out of cultivation, and much of this land is deserted so completely that only the state or timber companies can undertake its management; but much still remains as part of the farms which are still cultivated, and it is for those farmers who can still look after their woods that this book is primarily written. Many of these farmers send their sons to agricultural colleges where forestry must form an important item in the curriculum, and for these students Mr. Guise's book will serve as an admirable guide to forestry.

The book deals quite definitely with American conditions and American species. Nevertheless, I am inclined to think that for private owners, both in America and elsewhere, who want to introduce good business management into their woods this is the best book yet written in the English language. The first questions that such an owner should ask himself are: how much timber have I got? how fast is it growing? how much ought I to cut each year? and, how best can I utilize it? These are all questions which Guise's book will help him to answer.

To a trained forester all this is familiar as a working plan, or, as Guise prefers to say, a 'management plan'. The merit of this book is that it presents the methods and objects of a working plan in a simple form which is adapted to a small area of woodland. Suitable instructions are given for surveying, measuring, estimating values, and making records.

The two chapters on 'The Structure and Physiology of Trees' and 'Ecology of Woodlands', which precede the chapters on survey, volume, and increment, are just adequate to cover the subject of silvics. Silviculture comes later in the book, and in an important chapter dealing with 'The care and improvement of Woodlands' it is assumed that the owner will usually hope to improve existing stands rather than clear-fell and replant. Nevertheless, nursery work and planting are by no means ignored.

The section on utilization is very practical. It explains the value of logs, what is useful and what is not, skidding methods, the weight of logs, and the cost of transportation. There is a model 'contract for sale of timber' and an account of co-operative marketing associations. It is presumed that smaller products will be utilized on the farm, and all the simple methods of creosoting, including butt-creosoting of stakes, are dealt with. The new diffusion methods which may become very important in time are briefly mentioned.

This is a well-written and very practical book. W. E. HILEY.

31 : 31.4 : 33.36. HENDERSON, F. Y. **Timber, its properties, pests, and preservation.** Crosby Lockwood & Son Ltd., Stationers' Hall Court, London, E.C. 4. 1939. pp. 185.

Dr. Henderson's book is addressed to the busy man with 'neither the time nor the desire to master new terminology or to work through the detailed technical methods of other specialists'. Sections are devoted to the growth of the tree; the anatomical structure of wood; conversion; grain, texture, and figure; density; the problems arising from the presence of water in wood; strength; natural defects; durability and decay; destruction by insects; seasoning; preservation. There are brief notes on a variety of common timbers, and on timber identification, steam bending and veneers and plywood.

The book is written simply, and offers an interesting and practical account of timber, and of the contributions of research to its effective preservation. It is well illustrated. The sections dealing with fungi, insects, and preservation, as might be anticipated in a book designed for the 'practical man', deserve particular mention: the first has a table of characteristics to enable the recognition of the common types of rot, and gives advice on the procedure of vetting a house and on dealing with an attack of fungal decay; the second has a similar table as a guide to the recognition of dangerous insects; and the third answers many questions that will occur to the average timber user.

S. H. CLARKE.

02. THOMSON, T., and JERRAM, M. R. K. **An outline of forestry.** Thomas Murby & Co., London. 1938. pp. 208.

Even the most experienced forester would admit that he cannot always see the wood for the trees, the trees for the wood, or either for the demands imposed upon him by the interests of industry and the community at large. The list of things that affect forests and forestry is extensive, and there is a real need for a concise, readable account of the subject.

By presenting a bird's-eye view of the whole field, Thomson and Jerram's book goes far towards satisfying this need. It is expressly designed to prevent the student's plunging into a morass of detail at the outset of his studies in forestry, and also to satisfy the curiosity of the layman who has 'a serious desire to know what it is all about'. Technical terms have been largely avoided, and for those that are used a glossary is provided, with page references to each head-word.

The book is by no means a bare outline. Enough detail is supplied, particularly on the bionomical aspects of forestry, to give a good general understanding. Indeed, the bulk of the work is devoted to the foundations and practice of silviculture and forest protection; much less space is given to policy, economics (which is logically taken to include valuation and finance, mensuration, and utilization), and management. Any lack of balance in this treatment is compensated by insistence upon the truth that living trees and their environment are the most fundamental part of the subject-matter. The book is soundly and competently written and will doubtless be appreciated by students and the more serious laymen alike, but there is room for doubt whether it will attract the unregenerate members of the public, mentioned in the preface, who ask: 'Do you just cut down trees?' A need still exists for a book to cure the ignorance of the general public by supplying a little more jam with the pill, if this can be done without sacrificing its medicinal value.

In the present work a few misprints have crept in; 'chlorophyll' appears throughout docked of its final 'l'; Birch and Willow are referred to on p. 86 as softwoods, in spite of the definition of softwoods in the glossary in the usual sense of conifers; and by an obvious slip of the pen, an uneven-aged wood is defined in the glossary as 'strictly speaking, a wood in which the trees are all of the same age'. On the whole, however, the book is very free from such slips, and the publishers have served it well in the matter of production.

P. G. B.

6 : 02 : 94.3 : 97.2. DANNECKER, K. **The forest manager.** Translated by A. O. Weidelich. The American Forestry Association, Washington, D.C. 1939. pp. 172.

Dr. Dannecker's book was written with the object of helping the German farm woodland owner towards a better understanding and handling of his forest. The author has worked for many years with associations of forest owners and has administered the promotion of private forestry in Württemberg under the authority of the 'Reichsnährstand', a body uniting the associated agricultural interests under Government control. The translation omits most items which are unimportant to the American forest manager and adds some useful explanatory footnotes.

The first chapter is entitled 'Economic Value of the Forest', and includes an interesting account of the origin and development of farm woodlands in Germany. Chapter II deals with the more important forest trees, their characteristics and diseases, Chapter III with the forest soil and its treatment. The author urges farmers to abstain from removing forest litter, and shows that peat can be much more profitably employed for bedding. Probably the most valuable part of Chapter IV—'The Forest Stand and its Treatment'—is a simple and very clear explanation of the theory of thinning. The next chapter outlines the principal forms of forest and systems of management with special reference to selection and group-selection, which are considered the most appropriate forms of management for small forests. The last three chapters deal very briefly with harvesting, preparation, and utilization of forest products, forest regulatory legislation, and co-operative associations of forest owners. These have now been dissolved and their functions assumed by the 'Reichsnährstand'.

Written in a simple and stimulating style and illustrated with good photographs, Dannecker's book no doubt affords a valuable piece of propaganda in favour of proper forest management on farms.

I. K.

5 : 02. JERRAM, M. R. K. **Elementary forest mensuration.** Thomas Murby & Co., London. 1939. pp. 124.

This book gives a compact description of theories, methods, and instruments relating to elementary forest mensuration, with particular reference to British practice. Its simplicity and

descriptive character recommend it as an introduction to a subject which often becomes a snag to the forester who is not properly grounded in the basic principles of measurement. The contents are well indicated by the chapter headings. After two introductory chapters on the history and theory of measurement, the material is presented as follows: (III) The measurement of felled trees and their out-turn. (IV) The measurement of the standing tree. (V) Volume tables. (VI) The increment of individual trees. (VII) The measurement of woods. (VIII) Yield tables. (IX) The measurement of forests.

The frequent use of diagrams and of examples of actual field data for illustrating both theory and practice add much to the usefulness of the text. Tables of factors, equivalents, and like information of practical value are included in the appendix.

J. W. B. S.

31 (97). Cox, H. A. [Ed.] **A handbook of Empire timbers.** D.S.I.R. Forest Products Research. H.M. Stationery Office, London. 1939. pp. 214.

This publication replaces the publication with the same title (now out of print) published by the Empire Marketing Board in 1932. The new publication contains more up-to-date information and the number of species described has been increased to 78 hardwoods and 16 softwoods. The information given for each timber includes a general description of the timber, trade names, the habit and distribution of the tree, seasoning, mechanical properties, durability, preservative treatment, working qualities, uses, and supplies.

31 (42.1–8). **A handbook of home-grown timbers.** [2nd edition.] D.S.I.R. Forest Products Research. H.M. Stationery Office, London. 1939. pp. 87.

A second edition of the handbook of the same title published two years ago, revised and enlarged to form a companion volume to the Handbook of Empire Timbers.

33.36 (73). U.S.A. **Proceedings of the 35th annual meeting of the American Wood-Preservers' Association, Jan. 24–26, 1939. —With index to the Proceedings, 1930–1939 inclusive.** American Wood-Preservers' Association, 1427 Eye Street, N.W., Washington, D.C. 1939. pp. 503.

Includes reports of special committees on various aspects of wood preservation, service records of treated wood products, reports on the diverse uses of treated wood, and several research papers. Abstracts of a number of these papers are included in this issue of *Forestry Abstracts.*

61. Anderson, R. O. **Applied photogrammetry.** Privately published by author, Chattanooga, Tennessee. 1939. pp. 191. L.S.

7. Streyffert, T. Den skogsekonomiska teorien. [**The theory of forest economics.**] Svenska Skogsvårdsföreningens Förlag, Stockholm. 1938. pp. 240. [Sw.]

NOTES FROM ANNUAL REPORTS

Reports examined include: *British Guiana*: Report on the Forest Department for the year 1938. *Burma*: Report on forest administration in the Utilization Circle for the year ended the 31st March 1939. *Canada*: Twenty-first annual report of the National Research Council of Canada, 1937–8. *Central Provinces and Berar*: Report on forest research, 1938–9. *Ceylon*: Administration report of the Conservator of Forests for 1938. *Cyprus*: Annual report of the forest administration for the year 1938. *Dutch East Indies*: Verslag van den Dienst van het Boschwezen in Nederlandsch-Indië over het jaar 1938. (Report on the Forest Service during the year 1938.) *Fiji*: Annual report of the Forest Department for 1938. *Great Britain*: Report of the Forest Products Research Board for the year 1938. *Holland*: Verslag over den landbouw in Nederland over 1938. (Report on agriculture during 1938.) *Jammu and Kashmir*: Progress report on forest administration for the Fasli Year 1994–5 (ending Assuj 1995). *Michigan*: Ninth biennial report of the Department of Conservation, 1937–8. *Montana*: Eleventh report of the State Forester and State Park Director, 1938. *New Zealand*: Thirteenth annual report of the Department of Scientific and Industrial Research, 1938–9. *North Borneo*: Annual report of the Forest Department for 1938. *Norway*: Årsmelding om Det norske Skogvesen for 1938. (Annual report on the Forest Service for 1938.) *Seychelles*: Annual report of the Department of Agriculture for the year 1938. *Sind*: Annual administration report of the Forest Department for the year 1938–9. *United States* (1): Report of the Allegheny Forest Experiment Station for the calendar year 1938. U.S.D.A. Forest Service. *United States* (2): Annual report of the Appalachian Forest Experiment Station for 1938. U.S.D.A. Forest Service. *United States* (3): Report of the Chief of the Forest Service, 1938. *United States* (4): Annual report of Forest Products Laboratory, 1938. U.S.D.A. Forest Service. *Western Australia*: Report on the operations of the Forests Department for the year ended 30th June 1939.

The numbers in brackets indicate the pages of the reports to which the annotations refer.

GENERAL FORESTRY

New Zealand. A large area of the middle part of North Auckland Peninsula was at one time covered with a mixed Kauri–Podocarp–broadleaved forest, which has since retreated. This vegetation had a marked affect on the soil, that under Kauri (*Agathis* spp.) being heavily leached while tree species such as Kohekohe (*Dysoxylum spectabile*) and Puriri (*Vitex lucens*) maintained soil fertility (48).

United States (2). It has been determined that the great majority of Oak sprouts arise from dormant buds, that the sprouts utilize the root systems of the parent trees, that the formation of heartwood at point of union of sprout and parent tree is the factor determining transmission of decay, and that *Stereum gausapatum* is the fungus responsible for most of the Oak butt rot (12).

FOREST INFLUENCES

Cyprus. Aleppo Pine (*Pinus halepensis*), though growing at relatively lower elevations, appears to be more susceptible to snow break than Troödos Pine (*P. laricio*) (9).

SILVICULTURE

British Guiana. Experiments in 'frill girdling' indicate that a tree is killed more quickly by applying the poison to the upper surface of the cut bark than by pouring it into the frill. Sodium arsenite, at the rate of 1 lb. to 1 gal. of water, has been found the cheapest and most effective form of arsenic in this work (3). Bamboo (*Guadua angustifolia*) will not grow on heavily leached sand. On suitable soil the most successful method of planting is 'to take a strong side branch attached to a "heel" of the culm cut from the node'. Such planting material gave a 96 per cent. survival at the end of 52 days and a height growth up to 25 ft. at the end of a year (4).

Canada. A method has been developed by which hormone chemicals, used in the treatment of seeds and cuttings, are incorporated either with an inert dust or with a standard fungicidal dust (17, 19). Natural hybrids between *Populus grandidentata* and *P. alba* have been found and many of these show rapid growth, and, in a number of cases, their wood has been found satisfactory for match

stock (28). Cytological studies show that *P. grandidentata*, *P. tremuloides*, and *P. eugenii* are diploid species while *P. alba* and *P. canescens* have both diploid and triploid varieties. The extra set of chromosomes in the triploid appears to be partially responsible for the unusual size and vigour of certain trees. Twelve natural hybrids between *P. alba* and *P. grandidentata* and three between *P. alba* and *P. tremuloides* were all found to be diploids (28–9).

Central Provinces and Berar. Heavy cutting of immature pole crops in the low Teak forest and clear cutting of the high Teak forest to obtain even-aged stands does not appear to be justified, and clear cutting should be avoided where competitive vegetation, fire, or frost are likely to affect regeneration adversely (2–3, 5). Shelterwood cutting appears effective in Sal forests, both in protecting young growth from frost and in suppressing grass, thus reducing the fire hazard and keeping the forest floor clean to favour Sal regeneration (4–6). Excellent cotton crops have been grown between Teak sowings 6 ft. apart on black cotton soil that is fairly well drained. The cotton and Teak are weeded simultaneously two or three times in the first year (17). Winter burning does not damage 3-year-old Teak and Lendia (*Lagerstroemia parviflora*) coppice, although it kills Bija (*Pterocarpus marsupium*). Little damage is done by cattle to 2-year-old coppice of Teak, Bhirra (*Chloroxylon swietenia*), and Lendia, but the species Shisham (*Dalbergia sissoo*), Bija, and Tinsa (*Ougeinia dalbergioides*) are heavily browsed (28–9).

Cyprus. Experiments indicate that the broadcast sowing of *Pinus halepensis* on contour strips, about 10 ft. wide and cleared of scrub to allow free air circulation, is relatively successful in overcoming the effects of excessive soil and air temperature. The scrub growth should be retained on the intervening strips and brushwood should be piled below seeded strips to prevent erosion (19).

Dutch East Indies. In Java and Madoera 13,947 ha. were brought under Teak and 8,919 ha. under selected native species (47). Nearly all plantations are raised by the *taungya* method (11).

Holland. 857 ha. of State land and 446 ha. of municipal land were afforested, the latter being carried out with technical help and interest-free loans from the State (92–3).

Jammu and Kashmir. Artificial regeneration of Deodar (*Cedrus deodara*) both by seeding and planting on cut-over lands has given excellent results (12).

Michigan. Seeding of Pine in drills is found to be more efficient than broadcast sowing, the beds requiring relatively less weeding and cultivation, and a better stock of seedlings is produced. Seedlings rather than transplants are preferred for large-scale planting, the stock used being White Pine 3–0, Red Pine 2–0, and Jack Pine 2–0 (276–7).

Montana. Under State Law, timber operators may carry out their own slash disposal, using standard methods, or they may pay the State 15 cents per thousand bd. ft. to do this work. The latter method is followed for approximately 90 per cent. of all timber cut on private lands in Western Montana (42).

New Zealand. Experiments on the value of growth substances in the rooting of cuttings indicate that the condition of the wood, whether soft or hard, and the temperature and humidity at the time of soaking are factors which affect the amount of chemical absorbed and hence affect the final results (40).

Norway. 12,127 dekares were planted and sown, and 16,707 dekares were prepared for afforestation (46).

Seychelles. Soil fertility on cultivated slopes was improved by making contour drains and by the use of mulch and leguminous cover crops under stands of Excelsa Coffee trees (10).

Sind. In all areas where future flood conditions may be uncertain, Kandi (*Prosopis spicigera*) seed is mixed in Babul (*Acacia arabica*) sowings as insurance against drought (12). Babul has been grown successfully in conjunction with agricultural crops (23).

United States (1). A thinning in a 40-year northern hardwoods–Hemlock stand, which removes all trees other than those of promise for saw timber, produces a commercial yield of pulpwood or chemical wood but increases damage by glaze storms, at high elevations (6). The first thinning in White Pine plantations should be at 15 years, and even earlier in dense natural stands of Virginia Pine. A pole axe has been found to be the most effective tool for pruning dead White Pine branches up to 7 ft., and a hand saw above that height (6).

United States (2). Density of competing herbaceous vegetation is more important than variation in soil type in determining the survival of planted seedlings in this region (5). Successful results were obtained in seed-spot sowing of Oak and Walnuts (6). In pruning White Pine saplings, not

more than 20 per cent. of the living whorls should be removed if diameter growth is to be maintained (7).

United States (3). Three methods of harvesting—clear cutting, scattered seed tree, or shelter wood—are all silviculturally feasible in the Western White Pine type. The mechanical scarification of the soil prior to heavy cutting of Jack Pine, and the scattering of cone-bearing branches over the area after cutting, are necessary operations for the adequate regeneration of this species in the Lake States (44).

Western Australia. It has been determined that *Pinus radiata* requires a soil of higher nutrient content than does *P. pinaster*. Measures found to be most effective in restoring young Pine to normal growth were cultivation, application of superphosphate, and spraying very young plants with a solution of zinc salts (18).

EXTRACTION, UTILIZATION, AND MARKETING

British Guiana. Timber production from Crown Lands during the year totalled 1,058,167 cu. ft. of which 866,958 cu. ft. was Greenheart (*Ocotea rodioei*) (5).

Burma. Yellow staining of Yon (*Anogeissus acuminata*) timber, caused by the fungus *Penicillium* spp., resulted in a 5 per cent. reduction in static bending strength and a 20 per cent. reduction in impact bending strength (7–8). Kiln-drying tests of Thingadu (*Parashorea stellata*) indicate that this species is rather slow-drying and liable to distortion (8–9). A mixture of Seekay Wax A123 plus 20 per cent. of Maxphalt Bitumen R1 appears suitable as an end coating for timber and is not affected by temperatures up to 185° F. (12). The wood of Yon has proved highly satisfactory for tool handles (16).

Ceylon. Railway sleepers of Hora (*Dipterocarpus zeylanicus*), which were treated with creosote and crude oil, have been in service for some years and continue in good condition (16).

Cyprus. The total output from the State forests for the year was 903,793 cu. ft. (13). Tests indicate that pitprops of Cyprus *Pinus laricio* have similar strength value to Corsican Pine props grown in the British Isles, and props of *P. halepensis* were found to be 28 per cent. stronger than those of *P. laricio* (19).

Dutch East Indies. Laboratory tests suggest that *Pinus merkusii*, *Agathis dammara* (*A. alba*), and *Acacia decurrens* may prove suitable for pulp and paper manufacture (29). Of native timbers sent to Germany for tests as plywood, Red and White Meranti (*Shorea* sp.), Soentia (*Palaquium* sp.), *Agathis*, and *Anthocephalus* have been favourably reported on (29–30). Satisfactory drying schedules have been worked out for Kamferhout (*Dryobalanops* sp.), Balsa (*Ochroma* sp.), and 2½ cm. planks of Teak (59). The total timber production of Java and Madoera was 1,646,745 cu. m., most of which was Teak (73–4). The Outer Provinces produced 1,023,000 cu. m. of timber, 1,150,000 cu. m. of firewood, and 46,000 tons of charcoal (80).

Fiji. After seven years' experience in the use of native timbers in local mines, the following species are now used in the proportion indicated: Sacau (unidentified botanically) 60 per cent., Yaka (*Dacrydium elatum*) 15 per cent., Yasiyasi (*Eugenia* spp.) 15 per cent., Savai (*Heritiera littoralis*) 5 per cent., and Damanu (*Calophyllum burmanni*) 5 per cent. (3). The annual timber production is estimated at 4 million sup. ft., a little more than one-third of the consumption of the colony (3). Mangrove fuelwood is cut under licence, the charge for which is 10*s*. (3).

Great Britain. Variations in lignification of wood from a leaning stem of English Ash have been found to be due to development of tension wood, which, in this species, lacks the mucilaginous fibres typical of this tissue. Tests with a number of species indicate that abnormal strength properties of tension wood are less pronounced in the seasoned than in the green condition (6–7). A multiple-entry card key has been evolved for use in the identification of softwoods (8). For the study of the 'finish' of planed timber it is now possible to analyse the light scattered from planed wood surfaces into its specular and diffuse components (11–4). Elastic constants of wood may be measured by non-destructive vibration methods using strips approximately $28 \times 1 \times 0{\cdot}2$ in. Tests show that for both Beech and Sitka Spruce the rigidity modulus (G) is relatively more sensitive to moisture changes than Young's modulus (E) (14–8). In wood subjected to hydrostatic pressure and kept in an atmosphere of constant humidity, the vapour pressure of sorbed water rises, moisture evaporates, and the wood is left at a relatively low equilibrium moisture content, which returns to normal when pressure is released. This is of particular importance in the relation between tensile strength of adhesives and

the moisture content of laminated plywood (18–20). From investigations of the principles of wood cutting it was determined, for knife-edge cutting, that the relation of energy consumption per unit length or area of material planed (E) to feed speed (f) takes the form $E = Kf^{-n}$, where K is a constant partly dependent on spindle speed and the index n involves a function of the cutting angle. Operating costs are reduced with increase in feed speed, the controlling factor being quality of surface required. A reduction of cutting angle from 30° to 20° involves an increase of 25 per cent. in power consumption and of 100 per cent. for reduction from 30° to 10° (33–9). A new wood preservative mixture has been evolved consisting of mercuric chloride, potassium dichromate, and certain reducing salts as sodium sulphite and sodium nitrite, which does not have the usual disadvantages of a mercuric chloride preservative—corrosion of metals and tendency to leach out. This has yet to be tested in the field (41–2). The action of fire-proofing chemicals results in increased production of charcoal and water vapour, and a decrease in the yield of inflammable gaseous products (40–1). Water storage in a log pond was found to be an effective method of bringing about starch depletion (for control of *Lyctus* powder-post beetle) in sample logs of Oak and Ash over a period of 6–7 months. Walnut does not lose its starch as quickly as other species during water storage. Sea-water storage of logs of Oak, Elm, and Ash was not fully effective over a period of 5 years (45).

North Borneo. The volume of timber cut from licensed areas totalled 6,091,064 cu. ft. (5).

United States (2). There is evidence that posts and poles of the non-durable hardwoods and softwoods may be made resistant to insect and disease damage, at little expense, by the introduction of certain water-soluble salts into the living or freshly cut tree (13). From the number of wounded trees and the width of wounds immediately following a fire, an estimate can be made of the amount of cull in Appalachian Oak stands at any given period in the future (11).

United States (4). The use of pre-fabricated plywood panels in the construction of one- and two-storey houses has been found to be technically sound and practical (2). Chemical seasoning of heavy timbers greatly reduces the drying time and seasoning degrade as compared with mechanical seasoning (3). Four compounds which may prove useful as solvents, fungicides, adhesives, or plasticizers were obtained from wood for the first time when lignin was mixed with solvent dioxan in a heavy steel container and subjected, in the presence of hydrogen and a catalyser, to high pressure and temperature for several hours. The incorporation of lignin with the negative plate in a storage battery prolongs the life of the battery and enables it to maintain maximum power in zero weather for four times the usual period (4). Improvements have been made in the pulping and the multiple-stage chlorination bleaching of the pulpwood of Loblolly Pine and Jack Pine, and progress has been made in the production of high-grade bleached papers from sulphate pulps of the former species (5). A simple inexpensive method of treating fence posts for protection against decay involves placing zinc chloride in a discarded inner tube of a tire and attaching the tube to the butt end of a freshly cut post (7).

Western Australia. Timber production for the year totalled 12,422,000 cu. ft. (5).

PROTECTION

Canada. An investigation into the effect on vegetation of sulphur dioxide, contained in smelter fumes, has shown that the rate of absorption by the leaves, rather than the quantity absorbed, was the significant factor in determining the degree of injury. Most of the absorption of sulphur dioxide by conifers took place during the growing season and susceptibility to injury increased with a high relative humidity. Larch, Douglas Fir, and Yellow Pine were found to be extremely susceptible to sulphur dioxide during the spring and early summer, and of all the conifers Larch, in certain stages of growth, was found to be the most sensitive to this gas. Trees planted in irrigated plots were found to be more susceptible than those growing in natural habitat. It was determined that a considerable retardation in both height and diameter growth has been caused by the SO_2 (118–20).

Central Provinces and Berar. The cutting of climbers below the collar, splitting the stump and smearing it with kerosene oil, appears to be an effective control measure (22).

Dutch East Indies. Teak trees that were attacked by *Calotermes tectonae* were cut down and the infested parts burnt. Scattered Teak trees attacked by *Duomitus ceramicus* were removed during first thinnings (51).

New Zealand. Native termites (*Stolotermes ruficeps* and *Calotermes brouni*) are fairly widespread

in buildings in Auckland Province, particularly where foundations are of Puriri (*Vitex lucens*) (34). The most common cause of wood decay is the fungus *Poria ferruginosa* (83).

Seychelles. Scale insects on Citrus trees were effectively controlled by the application of a 5 per cent. aqueous solution of Diesel oil emulsion (10).

United States (1). 'Controlled burning' is less damaging in Oak-Pine than in pure Pine stands, and in treated than in untreated stands (5).

United States (2). The cause of swollen forest streams during heavy storms is not overland water flow but rather subsurface storm flow following natural drainage lines near the surface in contrast with normal ground water seepage (3). Lime-sulphur spray, used once a week during May, was found to be an effective control for the Hemlock twig rust, caused by *Melampsora farlowii* (12). In relation to the control of the powder-post beetle, starch content of wood may be regulated in some degree by selection of time of year for cutting and by certain methods of seasoning (13). The insect *Hylemyia cilicrura* caused considerable mortality in Red Cedar seedlings and it was determined that there was a direct relationship between the abundance of the insect and the kind of fertilizer used in the seedbeds (14). The insects *Xylobiops basilare* and *Oncideres cingulatus* appear to be responsible for the spread of the Persimmon wilt disease (14).

United States (3). Present and potentially important equipment for forest fire protection are the radio, and particularly a two-way radiophone unit for trucks, the autogiro, and a light motor-driven power tool for clearing fire lines (38).

Western Australia. Measurements of the moisture content of cylinders of *Pinus radiata*, ½ in. in diameter, give a satisfactory indication of degree of fire hazard (16).

ECONOMICS, MANAGEMENT, AND POLICY

Cyprus. The relinquishing of forest grazing privileges by four monasteries in return for land or cash compensation, the application of the Goats Law of 1913 by 143 villages up to the end of 1938, and the application of the Village Tree Planting Law of 1930 by 128 villages, all indicate progress in public opinion towards the necessity for curtailing forest grazing (7–8).

Dutch East Indies. In Java and Madoera 745,907 ha. of Teak forest (91 per cent. of the total Teak area) and 22,360 ha. of native species (1 per cent. of total area of native species) are now under completed working plans (40).

Fiji. The total area of forest is approximately 2¼ million acres (1).

Holland. A forest survey is progressing which will give complete data on the woods, roadside plantations, and waste ground of the country (93).

Norway. An amendment to the Forest Protection Law of 1932 was issued on May 13, 1938.

United States (3). Within the continental United States there are 630 million acres of forest land, 462 million acres commercial and 168 million acres non-commercial (16). Of the commercial forest land 341 million acres are under private ownership, 202 million acres being industrial and 139 million acres farm forests (17). There are 158 national forests (30). The current annual growth of saw timber is estimated at 363 million bd. ft. and annual saw-timber drain at more than 2 billion (10).

LIST OF ADDITIONAL ABBREVIATIONS

(Based on the *World List of Scientific Periodicals*)

Amer. Forests	American Forests. Washington, D.C.
Amer. Midl. Nat.	American Midland Naturalist. Notre Dame, Ind.
Anal. Inst. Cerc. Exp. for.	Analele Institutului de Cercetări și Experimentație Forestieră. Bukarest.
Ann. Acad. tchécosl. Agric.	Sborník Československé Akademie Zemědělské. Prague.
Ann. phytopath. Soc. Japan	Annals of the Phytopathological Society of Japan. Tokyo.
Appl. For. Note Northern Rocky Mt. For. and Range Exp. Sta.	Applied Forestry Note. Nothern Rocky Mountain Forest and Range Experiment Station. Missoula, Montana.
Bi-m. Bull. N. Dakota agric. Exp. Sta.	Bi-monthly Bulletin of the North Dakota Agricultural Experiment Station. Fargo, N.D.
Bi-m. Bull. Ohio agric. Exp. Sta.	Bi-monthly Bulletin. Ohio Agricultural Experiment Station. Wooster, Ohio.
Biol. Notes nat. Hist. Surv. Div., Illinois	Biological Notes. Natural History Survey Division, Illinois. Urbana, Ill.
Black Rock For. Pap.	Black Rock Forest Papers. Cornwall-on-the-Hudson, N.Y.
Bodenk. PflErnähr.	Bodenkunde und Pflanzenernährung. Berlin.
Bol. Dep. For. Caz. Pesc.	Boletín del Departamento Forestal y de Caza y Pesca, Mexico, D.F.
Bol. Inst. Pesq. tecnol. de S. Paulo	Boletin. Instituto de Pesquisas Tecnológicas de S. Paulo. São Paulo, Brazil.
Bol. téc. Minist. Agric. y Cria	Boletín Técnico. Ministerio de Agricultura y Cria. Caracas, Venezuela.
Boll. Staz. Pat. veg. Roma	Bollettino della R. Stazione di patologia vegetale (di Roma). Firenze.
Bot. Mag., Tokyo	Botanical Magazine. Tokyo.
Bull. Conn. agric. Exp. Sta.	Bulletin. Connecticut Agricultural Experiment Station. New Haven.
Bull. Duke Univ. Sch. For.	Bulletin. Duke University School of Forestry. Durham, N.C.
Bull. For. Dep. W. Aust.	Bulletin. Forest Department of Western Australia. Perth.
Bull. Soc. Nat. Moscou	Bulletin de la Société des naturalistes de Moscou. Moscow.
Bull. Univ. Mich. Sch. For. Conserv.	Bulletin. University of Michigan, School of Forestry and Conservation. Ann Arbor.
Bull. Univ. Minn. agric. Exp. Sta.	Bulletin. University of Minnesota Agricultural Experiment Station. St. Paul.
Canad. Ent.	Canadian Entomologist. Orillia, Ontario.
Carib. For.	Caribbean Forester. Río Piedras, Puerto Rico.
Cbl. gesamte Forstw.	Centralblatt für das gesamte Forstwesen. Vienna.
Cellulose Ind., Tokyo	Cellulose Industry. Tokyo.
Chem. Ind.	Chemistry and Industry. London.
Circ. Bull. Mich. St. Coll. agric. Exp. Sta.	Circular Bulletin. Michigan State College Agricultural Experiment Station. East Lansing.
Civ. Engng., Easton, Pa.	Civil Engineering. Easton, Pa.
Contr. Boyce Thompson Inst.	Contributions. Boyce Thompson Institute for Plant Research. Yonkers, N.Y.
Dom. For. Serv. Silvic. Res. Note	Dominion Forest Service Silvicultural Research Note. Department of Mines and Resources, Ottawa.
Econ. Note Lake States For. Exp. Sta.	Economic Note. Lake States Forest Experiment Station. St. Paul, Minn.
Ent. mon. Mag.	Entomologists' Monthly Magazine. London.
Ent. Tidskr.	Entomologisk Tidskrift. Stockholm.
Erdész. Lap.	Erdészeti Lapok. Budapest.
Ergebn. Enzymforsch.	Ergebnisse der Enzymforschung. Leipzig.
Ext. Bull. Mich. St. Coll.	Extension Bulletin. Michigan State College. East Lansing.
Fire Prot.	Fire Protection. Cincinnati, Ohio.
Fmrs'. Bull. U.S. Dep. Agric.	Farmers' Bulletin. U.S. Department of Agriculture. Washington, D.C.
For. Notes Coll. Agric. Calif.	Forestry Notes. College of Agriculture, Berkeley, Calif.
For. Res. Notes Pacific Northwest For. Exp. Sta.	Forest Research Notes. Pacific Northwest Forest Experiment Station. Portland, Oregon.
For. Surv. Release Southern For. Exp. Sta.	Forest Survey Release. Southern Forest Experiment Station. New Orleans, La.
For. Surv. Release Appalachian For. Exp. Sta.	Forest Survey Release. Appalachian Forest Experiment Station. Asheville, N.C.
For. Surv. Release California For. & Range Exp. Sta.	Forest Survey Release. California Forest and Range Experiment Station. Berkeley.
For. Treasures	Forest Treasures. Nicosia, Cyprus.
Gartenbauwiss.	Gartenbauwissenschaft. Berlin.
Imp. Bur. Soil Sci. Tech. Comm.	Technical Communication of the Imperial Bureau of Soil Science. Harpenden, England.

LIST OF ADDITIONAL ABBREVIATIONS

Industr. Engng. Chem.	Industrial and Engineering Chemistry. Easton, Pa.
Int. Mitt. Bodenk.	Internationale Mitteilungen für Bodenkunde. Berlin and Wien.
J. Anim. Ecol.	Journal of Animal Ecology. Cambridge, England.
J. Hered.	Journal of Heredity. Washington.
J.N.Y. ent. Soc.	Journal of the New York Entomological Society. New York.
J. New Engl. Wat. Wks. Ass.	Journal of the New England Waterworks Association. New London, Conn.
J. Rubb. Res. Inst. Malaya	Journal of the Rubber Research Institute of Malaya. Kuala Lumpur.
Jb. wiss. Bot.	Jahrbuch für wissenschaftliche Botanik. Berlin.
Leafl. U.S. Dep. Agric.	Leaflet. U.S. Department of Agriculture. Washington, D.C.
Mitt. Fachaussch. Holzfr.	Mitteilungen des Fachausschusses für Holzfragen beim Verein deutscher Ingenieure und deutschen Forstverein. Berlin.
Mitt. Schweiz. Anst. forstl. Versuchsw.	Mitteilungen der Schweizerischen Anstalt für das forstliche Versuchswesen. Zürich.
Mitt. Schweiz. ZentAnst. forstl. Versuchsw.	Mitteilungen der Schweizerischen Zentralanstalt für das forstliche Versuchswesen. Zürich.
New Phytol.	New Phytologist. Cambridge, England.
Notes For. Invest.	Notes on Forest Investigations. State of New York Conservation Development. Albany, N.Y.
Nuovo G. bot. ital.	Nuovo giornale botanico italiano (e Bollettino della Società botanica italiana). Firenze.
Paper Tr. J.	Paper Trade Journal. New York and Chicago.
Papp. Trävarutidskr. Finl.	Pappers- och Trävarutidskrift för Finland. Helsingfors.
Proc. Amer. phil. Soc.	Proceedings of the American Philosophical Society. Philadelphia.
Proc. Amer. Soc. hort. Sci.	Proceedings. American Society for Horticultural Science. College Park, Md.
Proc. Ind. Acad. Sci.	Proceedings of the Indiana Academy of Science. Brookville.
Proc. Soil Sci. Soc. Amer.	Proceedings. Soil Science Society of America. Ames, Iowa.
Punjab For. Rec.	Punjab Forest Records. Lahore.
Quart. Bull. Mich. agric. Exp. Sta.	Quarterly Bulletin. Michigan Agricultural Experiment Station. East Lansing.
Quart. nat. Fire Prot. Ass. Boston	Quarterly of the National Fire Protection Association. Boston, Mass.
Res. Note California For. & Range Exp. Sta.	Research Note. California Forest and Range Experiment Station. Berkeley.
Res. Note Southwestern For. & Range Exp. Sta.	Research Note. Southwestern Forest and Range Experiment Station. Tucson, Arizona.
Sci. Agric.	Scientific Agriculture. Ottawa.
Sci. Libr. Bibliogr. Ser.	Science Library Bibliographical Series. London.
Scot. For. J.	Scottish Forestry Journal. Edinburgh.
Soil Conserv.	Soil Conservation. Washington, D.C.
Soil Sci.	Soil Science. New Brunswick, N.J.
Southern Pulp & Paper J.	Southern Pulp and Paper Journal.
Sovetsk. Bot.	Sovetskaya Botanika. Leningrad.
Sovetsk. Subtrop.	Sovetskie Subtropiki. Sakhum, Georgia.
Sta. Note Central States For. Exp. Sta.	Station Note. Central States Forest Experiment Station. Columbus, Ohio.
Sta. Pap. Northern Rocky Mt. For. & Range Exp. Sta.	Station Paper. Northern Rocky Mountain Forest and Range Experiment Station. Missoula, Montana.
Str. Settlem. Gdns. Bull.	The Gardens' Bulletin. Straits Settlements. Singapore.
Svensk PappTidn.	Svensk Papperstidning. Stockholm.
Tech. Bull. Minn. agric. Exp. Sta.	Technical Bulletin. University of Minnesota Agricultural Experiment Station. St. Paul.
Tech. Note Allegheny For. Exp. Sta.	Technical Note. Allegheny Forest Experiment Station. Philadelphia, Pa.
Tech. Note Appalachian For. Exp. Sta.	Technical Note. Appalachian Forest Experiment Station. Asheville, N.C.
Tech. Note California For. & Range Exp. Sta.	Technical Note. California Forest and Range Experiment Station. Berkeley.
Tech. Note Lake States For. Exp. Sta.	Technical Note. Lake States Forest Experiment Station. St. Paul, Minn.
Tech. Note Northeastern For. Exp. Sta.	Technical Note. Northeastern Forest Experiment Station. New Haven, Conn.
Tech. Pamphl. For. Dep. Cyprus	Technical Pamphlet. Forest Department. Nicosia.
Trans. Amer. Soc. mech. Engrs.	Transactions of the American Society of Mechanical Engineers. New York.
Trees Pest Leafl., Boston	Tree Pest Leaflets. Massachusetts Forest and Park Association. Boston.
Trop. Agric., Trin.	Tropical Agriculture. The Journal of the Imperial College of Agriculture. Trinidad.
Woodlands Rev.	Woodlands Review. Gardenvale, Quebec.
Z. Bot.	Zeitschrift für Botanik. Jena.

LIST OF ADDITIONAL ABBREVIATIONS

Libraries, other than that of the Imperial Forestry Institute, from which literature was obtained for purposes of recording and abstracting in the present number of *Forestry Abstracts*.

Designation:	*Library of:*
C.G.B.	The Imperial Bureau of Plant Breeding and Genetics. Cambridge.
E.M.B.	The Imperial Bureau of Horticulture and Plantation Crops. East Malling.
H.S.B.	The Imperial Bureau of Soil Science. Harpenden.
L.S.	The Science Library. London.
O.B.D.	The Department of Botany. Oxford.
O.R.E.	The School of Rural Economy. Oxford.
O.R.S.	Radcliffe Science Library. Oxford.
P.R.	The Forest Products Research Laboratory. Princes Risborough.

Publications of the I.A.B. referred to in this number:

Hort. Abs.	Horticultural Abstracts. East Malling.
Pl. Breeding Abs.	Plant Breeding Abstracts. Cambridge.
R.A.E.	Review of Applied Entomology. London.
R.A.M.	Review of Applied Mycology. Kew.
S. and F.	Soils and Fertilizers. Harpenden.